FINAL REPORT

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REMEDIAL TECHNOLOGIES, ALTERNATIVES SCREENING TECHNICAL MEMORANDUM

REMEDIAL INVESTIGATION (RI)/FEASIBILITY STUDY (FS)

McINTOSH PLANT SITE
OLIN CORPORATION
McINTOSH, ALABAMA

Prepared for
Olin Corporation
Charleston, Tennessee

October 1992

WCC File 90B449C-6

Woodward-Clyde Consultants

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October 6, 1992

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VIA FEDERAL EXPRESS

Cheryl W. Smith
Senior Remedial Project Manager
United States Environmental Protection Agency
345 Courtland Street Northeast
Atlanta, Georgia 30365

Re: Remedial Technologies, Alternatives Screening
Technical Memorandum
Olin Chemicals/McIntosh Plant Site
McIntosh, Alabama

Dear Ms. Smith:

As part of the continuing preparation of the Feasibility Study for the subject site, the Remedial Technologies, Alternatives Screening Technical Memorandum (RTASTM) is being submitted today. This document builds on several previous submissions. The identification of candidate technologies and the evaluation of whether treatability testing would be required for OU-2 were presented in the Candidate Technologies Technical Memorandum (May 14, 1992). Tables 8 and 11 of today's submission are based on that document. A revised Remedial Action Objectives Technical Memorandum (RRAOTM) was submitted on April 30, 1992. The RRAOTM presented a list of remedial action objectives (RAOs) based on the preliminary results of the site characterization work and an evaluation of the potential Applicable or Relevant and Appropriate Requirements (ARARs). The RAOs are reiterated in today's submission as Table 5. The scope of this Remedial Technologies, Alternatives Screening Technical Memorandum (RTASTM) is as follows:

- Develop general response actions (GRAs)
- Identify, screen and select remedial technologies and process options; and
- Assemble remedial alternatives.

The Candidate Technologies Technical Memorandum (CTTM) submitted to EPA on May 14, 1992, included candidate technologies only for Operable Unit 2. The CTTM was limited to OU-2 because Phase III sampling for OU-1 included samples likely to affect candidate technologies, whereas OU-2 Phase III samples were only to determine extent. Therefore, a more complete identification and evaluation of OU-1 candidate technologies could be conducted after completion of the Phase III activities.

Today's submission includes the CTTM for OU-1 as part of the RTASTM to allow for evaluation of the Phase III data to appropriately select the OU-1 candidate technologies, with minimal impact to the overall RI/FS schedule (J.C. Brown, July 17, 1992). The candidate technology list for OU-1 is incorporated as Appendix A. The combined document is referred to as the RTASTM because the major emphasis is on screening the technologies and process options.

Future work on the feasibility study will include screening the assembled alternatives based on cost, effectiveness and implementability, and then conducting a detailed analysis of the alternatives that are retained after the screening process.

Please let me know if you have any questions regarding this submission or work in progress at McIntosh, Alabama.

Sincerely,

OLIN CORPORATION

J. C. Brown
Manager, Environmental Technology

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Enclosure

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FINAL REPORT 3 8 1263

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1.0 INTRODUCTION

Olin Chemical Corporation is implementing a remedial investigation/feasibility study (RI/FS) at their McIntosh, Alabama facility. The feasibility study is being conducted to develop and evaluate alternatives for an appropriate remedial action in order to prevent or mitigate the migration, release or threatened release of contaminants from the site. The purpose of this remedial technologies, alternatives, screening technical memorandum (RTASTM) is to identify and screen potentially applicable technologies and process options, and develop remedial alternatives for further evaluation. This document also includes the revised candidate technology list (Appendix A).

1.1 SITE BACKGROUND

The Olin Chemicals McIntosh plant is located approximately one mile east-southeast of the town of McIntosh, in Washington County, Alabama. A site location map is presented in Figure 1. The property is bounded on the east by the Tombigbee River, on the west, by land not owned by Olin, west of U. S. Highway 43, on the north by the Ciba-Geigy Corporation plant site and on the south by River Road.

Olin operated a mercury cell chlorine-caustic soda plant (constructed in 1951) on a portion of the site from 1952 through December 1982. In 1954, Olin began construction of a pentachloronitrobenzene (PCNB) plant on an adjacent portion of Olin property. The plant was completed and PCNB production was started in 1956. The McIntosh plant was expanded in 1973 to produce trichloroacetonitrile (TCAN) and 5-ethoxy-3-trichloromethyl-1,2,4-thiadiazole (Terrazole®). The PCNB, TCAN and Terrazole® manufacturing areas were collectively referred to as the crop protection chemicals (CPC) plant. In 1978, Olin constructed a diaphragm cell caustic soda/chlorine plant, which is still in operation. The CPC plant and mercury cell plant were shut down in late 1982. The McIntosh plant continues to operate and produces chlorine, caustic soda, sodium hypochlorite and sodium chloride and blends hydrazine.

The Olin McIntosh plant currently monitors and reports on numerous facilities within the plant that are permitted through the U. S. Environmental Protection Agency (EPA) and the Alabama Department of Environmental Management (ADEM). These include water and air permits as well as a Resource Conservation and Recovery Act (RCRA) post-closure permit. The RCRA post-closure permit includes groundwater protection for closed RCRA units including the weak brine pond, the stormwater pond and the brine filter backwash pond. The post-closure permit also requires corrective action for releases of 40 CFR 261 Appendix VIII constituents from any solid waste management units (SWMUs) at the facility. There are no active RCRA units at the facility. Olin also has permits for three injection wells for mining salt and a neutralization/percolation field.

In September 1984, Olin's McIntosh plant site was placed on the National Priority List of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or "Superfund." Groundwater contamination at the site has been established based on the results of various investigations. Mercury and chloroform are the principal contaminants identified in groundwater at the site. Mercury contamination was evidently caused by the operation of the mercury cell chlor-alkali plant during the period 1952 to 1982. The chloroform contamination is probably a degradation product from the operation of the CPC plant from 1954 to 1982.

Investigations have also indicated contamination in a 65-acre natural basin, herein referred to as the "basin," located on the Olin property east of the active plant facilities. This basin received plant wastewater discharge from 1952 to 1974.

On May 2, 1990, Olin signed an administrative order by consent (consent order) issued by EPA for the preparation, performance and oversight costs for the RI/FS at the McIntosh plant site. The final scope of work was attached to the consent order. A work plan was developed in partial fulfillment of the work items to be performed under the jurisdiction of the consent order and submitted to EPA on December 15, 1990. EPA commented on the work plan on April 4, 1991; an amended work plan was submitted to EPA on May 25, 1991 and approved on July 17, 1991.

Two operable units have been designated for the facility. Operable Unit 1 (OU-1) is the plant area (all of the Olin property except the area defined as OU-2). Operable Unit 2 (OU-2) is the basin, including the wetlands within the Olin property line and the wastewater ditch leading to the basin. Figure 2 is a facility layout map delineating the boundaries of the two operable units.

Following approval of the amended work plan, Phase I activities began with a bathymetric survey of the basin conducted over a four-day period from July 22 through July 25, 1991. This was followed by Phase I sediment and surface water sampling conducted in OU-2 from August 6, 1991 through August 30, 1991. A one-time sampling of selected monitor wells and corrective action wells within OU-1 was completed during the period September 9 through September 19, 1991. A vegetative stress survey involving vegetation sampling and detailed ground surveys for endangered and threatened plant species existing within OU-2 was also performed in September 1991. A macroinvertebrate study and fish sampling was performed during the period November 4 through 8, 1991. Phase II sediment sampling in OU-2 was completed on November 13 and 14, 1991. The Phase III work, conducted in August and September of 1992, consisted of sampling soils in OU-1; and surficial sediments, core sediments and macroinvertebrates in OU-2.

1.1.1 Operable Unit 1

Operable Unit 1 is all Olin property excluding the area designated as Operable Unit 2. Operable unit 1 contains closed, inactive and active Solid Waste Management Units (SWMUs). Seventeen of these SWMUs were identified in the amended work plan. Subsequently, EPA conducted a RCRA Facility Assessment (RFA) that listed 52 SWMUs and six areas of concern (AOCs) (A. T. Kearney, 1991). The list of SWMUs in the RFA report includes the seventeen SWMUs in OU-1 that were described in the amended Work Plan.

Olin has conducted numerous closure and removal activities to reduce or eliminate the potential for releases from the SWMUs in OU-1. Ten SWMUs have been closed or clean closed under 40 CFR 265. The closed and clean closed SWMUs are listed in the table below.

SWMUs CLOSED OR CLEAN-CLOSED UNDER 40 CFR 265		
Name	**Approval by ADEM**	**Approval by U. S. EPA**
1. Stormwater Pond (clean closed)	May 1, 1986	April 28, 1986
2. Brine filter backwash pond (clean closed)	May 1, 1986	April 28, 1986
3. Pollution abatement (pH) pond (clean closed)	August 14, 1985	August 13, 1985
4. Weak brine pond (closed)	August 9, 1987	June 24, 1987
5. Mercury waste pile storage pad (clean closed)	March 12, 1985	(ADEM had Interim Status Authority)
6. TCAN hydrolyzer (clean closed)	March 21, 1984	(ADEM had Interim Status Authority)
7. Mercury drum storage pad (clean closed)	March 12, 1985	(ADEM had Interim Status Authority)
8. Chromium drum storage pad (clean closed)	February 25, 1986	March 31, 1986
9. PCB/Hexachlorobenzene storage building (clean closed)	February 25, 1986	March 31, 1986
10. Hazardous waste drum (flammable) storage pad (clean closed)	February 25, 1986	March 31, 1986

Under the regulations (40 CFR 270.1(c)) surface impoundments, landfills, treatment units and waste piles that were clean closed under 40 CFR 265 are subject to the clean closure equivalency standards. At the Olin McIntosh facility, these include the three clean closed surface impoundments (the stormwater pond, the brine filter backwash pond, and the pollution abatement (pH) pond) and the one clean closed waste pile (the mercury waste pile storage pad).

The amended work plan listed ten SWMUs that were not regulated under 40 CFR 265 that have been identified within OU-1. These are summarized below:

Name	Status
Sanitary Landfills (2)	Closed, 1978 and 1984
Old Plant (CPC) Landfill	Closed 1976, Cap Improved 1984
Diaphragm Cell Brine Pond and Overflow Basin	Active
Ash Ponds (3)	1 Active and 2 Inactive
Lime Ponds (2)	Inactive (Closed in 1978 prior to RCRA)
Hexachlorobenzene Spoil Area	Removed Under CERCLA Emergency Removal Action, 1990

More details of the closure and removal activities that have been conducted at the site are presented in the Preliminary Site Characterization Summary (PSCS), that was submitted to EPA on April 16, 1992.

1.1.2 Operable Unit 2

Operable Unit 2 consists of the basin (65-acres), the wetlands within the Olin property line and the wastewater ditch leading to the basin. The basin is a natural feature lying within the flood plain of the adjacent Tombigbee River. During the seasonal high water levels (approximately 4 to 6 months per year), the basin is inundated by, and thus becomes contiguous with, the adjacent river.

The plant wastewater ditch currently carries the NPDES discharge and stormwater runoff from the east and southeast nonmanufacturing areas of Olin property to the Tombigbee River. From 1952 to 1974, plant wastewater discharge was routed through the basin and then to the Tombigbee River. In 1974, the discharge ditch was constructed (approximately 800 feet long during the non-flood season) to reroute the wastewater directly to the Tombigbee River, bypassing the basin itself.

In 1988, Olin completed the Basin Study Report (Olin, 1988). This study was done to provide information for the remedial investigation in accordance with CERCLA and in response to a Forward Planning Study of 1986 (Camp, Dresser, McKee, 1986).

Sampling of both sediment and basin water was conducted on December 8 and 9, 1987, under the observation of EPA Region IV officials. The samples were analyzed for mercury and a list of chlorinated benzenes. Mercury, dichlorobenzene isomers, pentachloronitrobenzene and hexachlorobenzene were detected in the sediment samples. Mercury concentrations in the basin surface water samples were reported at or below the Safe Drinking Water Act, Maximum Contaminant Level (MCL) of 2.0 μg/l. None of the organic analytes were detected in the surface water.

1.2 SUMMARY OF SITE CHARACTERIZATION

The site characterization activities for the RI consisted of evaluating existing data from previous investigations and existing sources, and sampling of the environmental media. The results, which are summarized in this section, are the basis for selecting candidate technologies. These results, when combined with remedial action objectives, are the bases for screening the technologies and process options and developing remedial alternatives. More details of the site characterization work are provided in the Preliminary Site Characterization Summary (PSCS).

Source Evaluation

A source evaluation was conducted for OU-1 by reviewing the existing RCRA monitor well data (37 wells and 17 monitoring events). The source evaluation identified the old (CPC) plant landfill as a potential continuing source of groundwater contamination for organics. The dense brine containing mercury in the vicinity of the former weak brine pond was identified as a potential secondary source of mercury to the groundwater. The sediments deposited in the basin and the ditches were identified as the primary source in OU-2.

OU-1 On-site Groundwater

There are two aquifers beneath the site, the Alluvial Aquifer and the Miocene Aquifer. The Alluvial Aquifer is generally unconfined, composed primarily of sands, and varies in thickness from about 55 to 80 feet in the plant area thinning to less than 40 feet at locations in the west plant area. In the vicinity of the site the average permeability (K)

is estimated to be 57 ft/day, the average transmissivity is estimated to be 3,500 ft^2/day, and the specific yield is estimated to be 0.20. The Alluvial Aquifer and the Miocene Aquifer are separated by the Upper Miocene Confining Unit, which is interpreted to be laterally continuous at the site and approximately 80 to 100 feet thick. The underlying Miocene Aquifer is the major source of drinking water in the area. Data from the RI sampling and ongoing RCRA sampling were used to characterize the groundwater. Thirty-three selected on-site wells (monitor, production, and corrective action) were sampled for the RI/FS. The selected wells were sampled and analyzed for the following constituents as specified in the EPA Contract Laboratory Program (CLP): Target Compound List (TCL) volatile organics; TCL semivolatile organics; TCL pesticides/PCBs; Target Analyte List (TAL) mercury (total and dissolved); a subset of the Target Analyte List that includes the thirteen metals on the priority pollutant list and cyanide. The groundwater samples were also analyzed in the laboratory for chloride. Field analyses included pH, specific conductance and temperature.

Table 1 summarizes the TCL and TAL constituents reported in the groundwater samples. Mercury and organics (dominantly chloroform, chlorobenzene and the dichlorobenzene isomers) were reported in samples from the on-site monitor wells screened in the Alluvial Aquifer. Figure 3 and Figure 4 delineate the estimated areal extent of mercury and organics in the groundwater, respectively. The data indicate that Olin's Corrective Action Program, a five-well pump and treat system, is effective at recovering groundwater migrating from any known, past or current sources. Chlorobenzene, 1,2-dichlorobenzene and 1,4-dichlorobenzene were reported in the groundwater sample from a process water well screened in the Miocene Aquifer. The contamination in the Miocene Aquifer appears to be localized in the vicinity of the process water well. Because of the extensive pumping of the Miocene Aquifer for process water (two wells pump continuously at approximately 1,000 gpm each) it is believed that there is little potential for contaminant migration away from the facility in the Miocene Aquifer. The Miocene Aquifer contamination is being addressed in more detail for the RI report.

OU-1 Off-site Groundwater

Forty-three domestic wells within a 3-mile radius of the facility were identified as drinking water wells. Thirty-four of these wells were determined to be feasible for sampling. The 34 wells were sampled as part of the site characterization activities. The samples were analyzed for total mercury, TCL volatile organics, total organic carbon (TOC), total dissolved solids (TDS), total suspended solids (TSS), and chloride. The TCL volatile organics were selected as the organic analytes based on the results of the on-site sampling. The TCL semivolatile and pesticide/PCB analyses were not included based on their low concentrations in on-site groundwater.

The results of the off-site groundwater sampling are summarized in Table 2. Mercury was reported in only one sample and volatile constituents were quantified in three samples and estimated (because they were less than the validated quantification limit) in eight other samples. All reported concentrations were well below the respective EPA Primary Drinking Water Standards.

OU-1 Soils

This discussion of OU-1 soils is based on a preliminary review of Phase III analytical data. The data are currently being validated as per Functional Guidelines, which may affect the interpretation of the analytical results. Phase III data are summarized below only for the purpose of this technical memorandum. Additional details and data analysis will be presented in the draft RI report based on the final validated data. Any modifications to the selection of treatment technologies or alternatives indicated by the detailed review of the Phase III results will be reflected in the draft FS report.

The purpose of the Phase III soil sampling in OU-1 was to investigate the old plant (CPC) landfill, which has been identified as a potential continuing source of groundwater contamination, and to sample additional SWMUs/AOCs identified in the RFA as requiring further investigation. Based on a review of the information presented in the RFA report and Olin's knowledge of past operations of the facility, the following closed SWMUs and AOCs were sampled.

- Old plant (CPC) landfill
- Former CPC plant
- Old plant landfill drainage ditch
- Sanitary landfills
- Lime ponds
- Former Mercury cell plant
- Strong brine pond
- Well sand residue area

Figure 5 shows the OU-1, Phase III sample locations. Appendix B summarizes the preliminary TCL and TAL Phase III results that were reported above the quantitation/detection limits for the old plant (CPC) landfill, the former CPC plant, the old plant landfill drainage ditch, and the sanitary landfill samples. The results for the other SWMUs/AOCs are summarized in the discussion.

When concentrations exceeded the calibration range for the GC/MS instrument, the sample was diluted and reanalyzed and only the result from analysis of the dilution is listed in Appendix B (with a D qualifier). The results for both the original and diluted analyses are listed for the pesticide/PCB data pending further review and data validation. The common laboratory and field contaminants that were reported in the samples (acetone, 2-butanone, carbon disulfide, methylene chloride and bis(2-ethylhexyl)phthalate) are listed in Appendix B, generally followed by a B qualifier indicating that they were also detected in an associated blank sample. Because these analytes are considered field and laboratory contaminants at the reported values, they are not addressed further. The target compounds are the focus of this discussion. The occurrence of frequently reported tentatively identified compounds (TICs) is addressed in a qualitative manner. Further evaluation of the TICs will be conducted during data validation.

The four clean closed SWMUs that are subject to the clean closure equivalency demonstrations (the stormwater pond, the brine filter backwash pond, the pollution abatement (pH) pond and the mercury waste pile storage pad) were also sampled during Phase III. These results will be presented with the clean-closure equivalency demonstrations.

Old Plant Landfill. The site of the old plant (CPC) landfill (Figure 2) was utilized until 1972 to neutralize acidic wastewater from CPC plant operations. Neutralization was conducted by flowing the wastewater over piles of oyster and clam shells. The flow was then directed by an overflow ditch to the main plant wastewater ditch. Plant personnel indicate that the former landfill also received organic wastes from the former CPC plant consisting of hexachlorobenzene and trichloroacetonitrile residue. It is reasonable to assume that other organic wastes from monochlorobenzene production were also placed in this unit.

Four soil borings were completed in the landfill area through the residual waste material and underlying clay aquitard and 20 feet into the underlying Alluvial Aquifer. The soil and residual waste samples were analyzed for CLP TCL volatile organics, TCL semivolatile organics, pesticides/PCBs and the selected list of TAL constituents. A minimum of four samples were collected from each boring at the following intervals:

- One sample of the residual waste material
- One sample from the base of the underlying clay aquitard
- One sample of the underlying Alluvial Aquifer, from the interval showing the highest headspace measurement
- One sample from the base of the boring

The lithologic descriptions from the Phase III borings indicate that the landfill area is overlain by top soil and a 2 to 4 foot clay cap. Silty clay fill material, from about 4 to 12 feet thick, was encountered beneath the clay cap in each of the borings. This fill layer contains residue of the waste that was disposed in the landfill. Shell, rock and wood fragments were found throughout the fill, and in boring BOP2, the fill/waste zone contained about six feet of a lime substance. Saturation at the base of the fill/waste zone was apparent in each of the borings. The most distinct saturated layer was encountered at boring BOP1, located in the northwest corner of the landfill. An approximate nine foot zone of very wet, loose silt/clay, with little or no apparent strength was found beneath the fill/waste material at BOP1. A stiff, gray, red and brown clay ranging from 3 to 17 feet thick, was encountered beneath the fill/waste and saturated zones. Each boring penetrated 20 feet into the reddish yellow, fine to coarse grained sand of the Alluvial Aquifer. The sand was described as damp to wet at the

base of the borings. Total depths for the four landfill borings ranged from 40 to 48 feet below ground surface.

The preliminary results for the volatile organics and semivolatile organics are summarized in Table 3. The constituents most commonly detected in the samples from the fill/waste zone included the target organic compounds chlorobenzene, the dichlorobenzene isomers, 1,2,4-trichlorobenzene, 1,2,4,5-tetrachlorobenzene, and hexachlorobenzene. Hexachlorobenzene was detected in the fill/waste samples at concentrations from 13 mg/kg to 170 mg/kg. Pentachlorobenzene and pentachloronitrobenzene are the most common TICs that were reported in the fill/waste samples, at estimated concentrations ranging from 1.5 mg/kg to 140 mg/kg for pentachlorobenzene and 1.3 mg/kg to 250 mg/kg for pentachloronitrobenzene. Based on the Phase III analytical results, the fill/waste zone generally contains less than 0.1 percent chlorinated organics.

A sample of the loose saturated silt/clay found in BOP1 was collected for analysis. The results were similar to the analyses of the fill/waste material. The volatile constituents chlorobenzene, benzene, chloroform, and tetrachloroethene were detected in this silt/clay sample. Chlorobenzene was the volatile constituent detected at the greatest concentration (60 mg/kg). Semivolatile chlorinated benzene concentrations ranged from 7.1 mg/kg for 1,3-dichlorobenzene to 140 mg/kg for hexachlorobenzene. Pentachlorobenzene and pentachloronitrobenzene were reported at estimated concentrations of 75 mg/kg and 250 mg/kg, respectively.

The volatile organic compounds were more common in the clay than the overlying fill/waste material; chlorobenzene was reported in all five clay samples at concentrations ranging from an estimated concentration below the quantitation limit of 0.007 mg/kg at BOP3 to 7.3 mg/kg in BOP1. The semivolatile compound hexachlorobenzene, which was the target compound detected at 170 mg/kg in a fill/waste sample, was detected in only one of the clay samples at an estimated concentration below the quantitation limit of 0.4 mg/kg (BOP4). The dichlorobenzene isomers were reported in clay samples from the two western borings, at concentrations up to 74 mg/kg (for 1,4-dichlorobenzene in BOP4).

The target organics detected in the Alluvial Aquifer material included chlorobenzene, 1,1,1-trichloroethane, chloroform, benzene, the dichlorobenzene isomers, 1,2,4,5-tetrachlorobenzene, 1,2,4-trichlorobenzene, hexachlorobenzene, fluoranthene, and phenol. Similar to the data from the clay samples, there are distinct lateral variations in the reported concentrations in the Alluvial Aquifer material. The semivolatile chlorinated benzenes were detected in samples from the two borings on the western side of the landfill (BOP1 and BOP4) up to 150 mg/kg for 1,4-dichlorobenzene, but were not detected in samples from the two eastern borings. Similarly, the volatile concentrations were higher in samples from the western borings BOP1 and BOP4 with chlorobenzene up to 46 mg/kg, but were less than 0.05 mg/kg in the aquifer samples from eastern borings BOP2 and BOP3.

Phenol was detected in both the clay and the Alluvial Aquifer material in borings BOP2 and BOP4 and also the loose silt/clay sample from BOP1. Phenol is not a common constituent found in the groundwater at the Olin facility.

Pesticide/PCB compounds were reported in the CPC landfill samples, at concentrations less than 1.0 mg/kg. A preliminary review of the data suggests that identification and quantification of some of the reported pesticide/PCB analytes may be suspect, possibly due to interferences from the waste material. Additional investigation of these analytical issues will be conducted as part of data validation, and will be reported in the draft RI report. Based on the pesticide/PCB concentrations reported in the preliminary data as compared to the semivolatile and volatile results, the pesticide/PCB results should not significantly affect the selection of technologies and alternatives for OU-1 soils.

Mercury concentrations detected in the fill/waste samples are summarized below:

Boring	Sample Interval (ft)	TAL Mercury Concentration (mg/kg)
B0P1	10 - 12	<0.25
B0P2	2 - 8	57.1
B0P3	4 - 5	21.7
B0P4	4 - 6	406

Mercury was detected in the silt/clay sample from BOP1 at a concentration of 0.42 mg/kg. Mercury was only detected in one of the five clay samples (BOP21 at 0.62 mg/kg) and mercury was not detected in any of the Alluvial Aquifer samples.

Considering analytical variability and natural variations in soils, the preliminary TAL results indicate that the reported concentrations of the TAL analytes (other than mercury) in the CPC landfill samples are generally within a range commonly found for naturally occurring soils.

Former CPC Plant. Two soil borings were completed at the western and southern boundaries of the former CPC plant area. The two borings were drilled to depths between 10 and 20 feet into the underlying Alluvial Aquifer. Four soil samples were collected from each boring and analyzed for CLP TCL volatile organics, TCL semivolatile organics, TCL pesticides/PCBs, and the selected list of TAL constituents.

The samples were collected at the following intervals:

- One sample from the upper clays, from the interval showing the highest headspace measurement
- One sample from the base of the upper clays

- One sample from the underlying aquifer, from the interval showing the highest headspace measurement
- One sample from the base of the boring

The former CPC plant area borings encountered 10-12 feet of clay overlying sands and silts of the Alluvial Aquifer material. The boring completed to the south of the plant was to a depth of 20 feet; the one completed to the west of the plant was to 32 feet. Groundwater was not encountered in either of the borings. The preliminary analytical results are presented in Appendix B. There were distinctly different results from the two borings. Hexachlorobenzene was the only target chlorinated benzene detected in the clay sample from the boring completed to the south of the former plant (BCP2) at an estimated concentration below the quantitation limit of 0.13 mg/kg. Chloroform was detected in the upper clay material from BCP2 at an estimated maximum concentration below the quantitation limit of 0.008 mg/kg. No target compounds besides those found in the blanks were detected in the BCP2 Alluvial Aquifer samples.

The boring completed to the west of the former CPC plant (BCP1) showed chlorobenzene at a maximum concentration of 0.54 mg/kg in the upper clay material. The detected, target semivolatile chlorinated benzenes in the two clay samples ranged from an estimated concentration of 0.2 mg/kg for hexachlorobenzene to 750 mg/kg for 1,2,4,5-tetrachlorobenzene. Pentachlorobenzene was the most common TIC reported in the clay samples at a maximum estimated concentration of 340 mg/kg. Concentrations in BCP1 decreased with depth in the Alluvial Aquifer. Only two target chlorinated benzenes were detected in the bottom sample from BCP1 (30-32 feet): hexachlorobenzene at 1.5 mg/kg and 1,2,4,5-tetrachlorobenzene at 0.055 mg/kg. The soil screening data provide further evidence of a distinct decrease in concentrations with depth. The Organic Vapor Analyzer (OVA) reading in the 12-14 foot interval was 190 ppm, while 10 ppm was reported in the 14-16 foot interval. OVA readings at the base of the boring were near background.

Mercury was not detected in former CPC plant area samples. Considering analytical variability and natural variations in soils, the preliminary TAL results indicate that the reported concentrations of the other TAL analytes are generally within a range commonly found for naturally occurring soils.

Old Plant Landfill Drainage Ditch. One shallow soil boring was completed in the vicinity of the old plant landfill drainage ditch to a depth of approximately 10 feet. Two composite soil samples were collected from the boring, one from the 0- to 1-foot interval and one from the 1- to 10-foot interval. The two composite samples were analyzed for CLP TCL volatile organics, TCL semivolatile organics and TCL pesticides/PCBs, and the selected list of TAL constituents. Hexachlorobenzene was detected in the 0-1 foot sample at 5.6 mg/kg and in the 1-10 foot sample at 2.7 mg/kg. Two pesticide/PCB compounds were detected at low concentrations in the 1-10 foot sample: beta-BHC at 0.0024 mg/kg and 4,4'-DDE at 0.0051 mg/kg. Mercury was detected at 0.95 mg/kg in the 0-1 foot sample and at 10.2 mg/kg in the 1-10 foot sample. Considering analytical variability and natural variations in soils, the preliminary TAL results indicate that the reported concentrations of the TAL analytes (other than mercury) in the Old plant landfill drainage ditch samples are generally within a range commonly found for naturally occurring soils.

Sanitary Landfills. Three borings were completed at randomly selected locations in the sanitary landfills. Each boring was drilled to the base of the landfill waste and composite samples were collected of the waste profiles. The samples were analyzed for CLP TCL volatile organics, TCL semivolatile organics and TCL pesticides/PCBs, and the selected list of TAL constituents. The samples were also analyzed for TCLP mercury.

The primary focus of the sampling was to address the report cited by the RFA Contractor (CERCLA draft file Summary), which suggested that the landfills received wastes containing hexachlorobenzene and mercury sludges. Hexachlorobenzene concentrations in the three samples ranged from 9.5 mg/kg to 44 mg/kg. Mercury concentrations ranged from 7.8 to 27.1 mg/kg. Mercury was not detected in the extract from the TCLP tests for any of the three sanitary landfill samples. The reported total mercury and hexachlorobenzene concentrations probably reflect the disposal of contaminated fill and other debris rather than direct disposal of waste as suggested in the report cited by the RFA Contractor. Other organics reported in the sanitary landfill samples included the target chlorinated benzenes. Chlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, and 1,3-dichlorobenzene were reported in all three samples at concentrations up to 7.4 mg/kg.

Pentachlorobenzene and pentachloronitrobenzene were also tentatively reported in the landfill samples at estimated concentrations ranging from 1.0 mg/kg to 3.6 mg/kg for pentachlorobenzene and 0.16 mg/kg to 31 mg/kg for pentachloronitrobenzene.

Polynuclear aromatic (PNA) compounds (e.g. fluoranthene, phenanthrene, fluorene, etc) commonly associated with wood treating products were reported in two of the sanitary landfill samples at concentrations from an estimated concentration of 0.041 mg/kg for fluorene to 4.6 mg/kg for phenanthrene. The occurrence of these compounds is possibly the result of disposal of treated poles, railroad ties and associated fill material. None of these constituents were reported in the sanitary landfill groundwater samples collected as part of the RI activities.

PCBs were reported in two samples, at a maximum concentration of 0.54 mg/kg for Arochlor 1248. Two other pesticide/PCB compounds were reported at very low concentrations: endrin aldehyde at 0.0067 mg/kg and gamma chlordane at 0.0036 mg/kg.

Considering analytical variability and natural variations in soils, the preliminary TAL results indicate that the reported concentrations of the TAL analytes (other than mercury) in the sanitary landfill samples are generally within a range commonly found for naturally occurring soils.

Lime Ponds. There are two former lime ponds in Operable Unit 1. The ponds contain lime (from the absorption and capture of residual chlorine gas) and lime sludges. These two ponds operated from 1968 to 1976 and were closed in 1979 (prior to RCRA) with a clay cap, topsoil and grass. The RFA suggested sampling of the lime waste to determine whether the lime ponds may be a source of mercury to the groundwater in the area. One soil boring was completed near the center of each of the two ponds. A composite sample of the buried lime waste was obtained from each boring and analyzed for mercury (total and TCLP).

The closed lime ponds are situated about 10 to 15 feet above natural grade. Based on the Phase III borings, the lime waste in these ponds is covered by 0.5 ft. to 6.0 ft. of clay/sandy clay and about 10 feet of ash material. The ash was used as fill material

when the ponds were closed and is described as saturated 6 to 8 feet below the surface. Considering that the water table in the area is about 25 to 30 feet below the lime waste, the ash is interpreted to be saturated from water that is perched on the lime waste and/or the underlying stiff clay layer. The estimated thickness of the lime waste varied from 1.5 feet to 2.0 feet for the two ponds. The preliminary sample results are summarized below:

Boring	Sample Interval (ft)	TAL Mercury Result (mg/kg)	TCLP Mercury Result (mg/l)
BLP1	16 to 18	1.3	0.01
BLP2	12 to 14	0.46	0.003

The TAL results shown above indicate that the lime wastes contain little mercury. In addition, the TCLP tests yielded leachate concentrations of no greater than 0.01 mg/l mercury, indicating a low potential for mercury to be leached from the waste. The distance from the lime waste to the groundwater table is estimated to be about 25 to 30 feet. The saturation of the ash indicates that the lime waste and/or the underlying clay have relatively low permeability. Therefore, given these conditions and the reported leachate concentrations from the TCLP tests, the lime waste is not considered a significant continuing source of mercury to the groundwater.

Former Mercury Cell Plant. The former mercury cell plant is an area approximately 180 feet by 250 feet that was the site of the structures and operations for the former mercury cell chlor-alkali plant. The mercury cell plant was shut down in 1982. The area was decommissioned and capped in 1986. Decommissioning included removal of all aboveground structures. The concrete pads and foundations were left in place and the area was covered with asphalt. Sampling was conducted to assess whether any past release of mercury to the shallow soils is a continuing source of groundwater contamination. Six shallow soil borings were completed at the former mercury cell plant area (Figure 5). The borings were advanced to a depth of approximately 4 feet below the concrete slab. One composite sample of the complete 4-foot interval was obtained from each boring and analyzed for mercury (total and TCLP). The preliminary results are summarized below:

Boring	Sample Interval (ft)	TAL Mercury Result (mg/kg)	TCLP Mercury Result (mg/l)
BMC1	0 to 4	<0.12	<0.002
BMC2	0 to 4	<0.12	<0.002
BMC3	0 to 4	<0.12	<0.002
BMC4	0 to 4	164	0.004
BMC5	0 to 4	0.38 0.16 (Duplicate)	<0.002
BMC6	0 to 4	3.4	<0.002

Total mercury was detected at three of the six sample locations. Leachable mercury from the TCLP test was detected in one sample (BMC4) at a concentration of 0.004 mg/l; the corresponding total mercury concentration reported in this sample was 164 mg/kg. These data indicate that although mercury occurs sporadically in the soils underlying localized areas of the former mercury plant, the soil matrix is not conducive to leaching. Considering that there is minimal downward movement of water in the area because the soils are overlain by a concrete slab and asphalt cover, the soils underlying the mercury cell plant are not considered a significant continuing source of mercury to the groundwater.

Strong Brine Pond. The strong brine pond was a former process unit that was removed in 1985. It was approximately 350 feet by 350 feet, and constructed partially above-grade in natural clay. The strong brine pond was a holding pond for the strong brine process fluid that was removed from the brine wells for use in the mercury cell plant. The pond was sampled to assess whether mercury-containing brine seeped from the pond and contaminated the underlying soils to the extent that mercury can be leached to the groundwater. Two soil borings were completed to a depth of 2 to 4 feet into the natural soils below the base of the pond. One sample of the natural soil from the base of each boring was collected and analyzed for TCLP mercury. Mercury concentrations from the TCLP leachate were 0.005 mg/l and 0.030 mg/l for the two samples. These results indicate that while some mercury has migrated to the natural soils beneath the former pond, the potential for this mercury to leach from the soils is low. The leachate concentrations indicate that the soils are not a significant source of mercury to the groundwater, particularly since the depth to groundwater is about 30 feet in the area. The potential impact to groundwater will be further evaluated in the RI report.

Well Sand Residue Area. Well sands were generated during the period from 1951 to 1968 from development and operation of the brine wells for the mercury cell chlor-alkali process. These sands are residues of the natural insoluble material from the salt domes. During early operation of the mercury cell plant, when the well sands were generated, they were deposited in mounds in an area referred to in the RFA as the well sand residue area. The well sand in these mounds is a cemented, granular material that has the consistency of sandstone, and the area is currently fenced to prevent access. The well sand material was sampled to determine the mercury content and assess the leachability of any detected mercury. Samples were collected at ten randomly selected areas and depths within the mounds; the 10 individual samples were ground and composited into one sample for analysis (mercury and TCLP mercury). The total mercury concentration detected in the well sand composite sample was 20.1 mg/kg. Mercury was not detected in the leachate from the TCLP analysis. Although mercury is contained in the well sand, the mercury is not leachable (based on the TCLP test). Also, because of the well sand consistency there is little potential for dust generation or exposure from incidental direct contact. Furthermore, the well sand area is fenced, thus limiting the potential for exposure to trespassers.

OU-2 Sediments

Prior to the Phase I sediment sampling, a bathymetric survey was conducted of the basin. Based on this survey, the maximum depth of the basin is 38.5 feet; approximately two-thirds of the basin area is relatively flat with water depth less than 6 feet. Core sediment samples were collected at three sample locations during the Phase I sediment sampling. Two cores were obtained from the basin and one from the former wastewater ditch. Each core was completed to an approximate depth of 5 feet and samples were collected at approximate 1-foot intervals. In addition to the core sampling, 112 grab surface samples were collected on a grid established at approximate 200 feet spacing across the basin and the ditches. All Phase I samples were split and analyzed for TAL mercury by CLP procedures. In addition to the mercury analyses, selected split core samples and grid samples were analyzed for soluble mercury, pH, total organic carbon (TOC), sulfide, sulfate, and CLP parameters including the selected list of TAL constituents, TCL volatile organics, TCL semivolatile organics, and pesticides/PCBs. The remaining samples were analyzed for selected organic indicator constituents

(hexachlorobenzene, pentachlorobenzene and pentachloronitrobenzene) using a laboratory screening technique. The TCL and TAL constituents reported in the Phase I sediment samples are summarized in Table 3. Five additional cores (3 in the basin and 2 in the wastewater ditch) were completed during the Phase II sampling. The core locations and analytical parameters for the Phase II cores were selected based on the Phase I results.

The surficial sediments in the basin were described as tan black and dark gray silty clays and clayey silts with occasionally sands. Except for the samples from the few sandy areas (3 of 22 samples) greater than 80 percent of the material passes the No. 200 sieve. The TOC is generally greater than 10,000 mg/l. The water content is commonly greater than 50 percent. The sediments in the wastewater ditch were described as a mixture of soft silt and clay and firm to medium sands.

The dominant constituents related to the Olin facility are mercury and hexachlorobenzene, with lesser concentrations of other dichlorobenzene isomers. Additionally, pesticide constituents (dominantly 4'4'-DDT, 4'4'-DDD and 4'4'-DDE) were also reported in the sediment samples. At least one of the DDT constituents was detected in each of the basin grab samples.

In addition to mercury, other TAL constituents were reported in the sediment samples at concentrations that may be considered above background (e.g., antimony, cadmium, selenium, and cyanide). It is not evident whether the reported concentrations in the sediments are due to contamination, naturally occurring variations in the sediments or analytical variability. The significance of these reported concentrations are being evaluated in the baseline risk assessment. Background samples were collected and analyzed for TAL constituents during the Phase III sampling to aid in the interpretations.

Based on the nine cores, at seven locations, the maximum vertical extent of contamination is estimated to be approximately seven feet, in the basin, near the former wastewater ditch. Mercury, and organics (hexachlorobenzene and chlorobenzene) were detected at the base of one of the Phase II cores (5 feet) completed in the current wastewater ditch. An additional core was then completed at this location during Phase

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III to a deeper depth (6 to 11 feet) and samples from this core were analyzed for mercury, hexachlorobenzene and volatile organics. Based on preliminary Phase III results, hexachlorobenzene was not reported at or above the detection limit in any of the Phase III core samples; mercury was not detected below a depth of 9 feet; and the chlorobenzene concentrations in the bottom four intervals (7 to 11 feet) varied from 0.019 mg/kg to 0.34 mg/kg; a chlorobenzene concentration of 0.19 mg/kg was detected in the 10- to 11-foot interval.

Mercury concentrations in sediments varied from below the sample detection limit in the northwest part of the basin to a maximum detected concentration of 290 mg/kg in the northeast part of the basin. Generally, the data showed three areas with mercury concentrations greater than 200 mg/kg and two areas with mercury concentrations between 100 mg/kg and 200 mg/kg.

The distribution of hexachlorobenzene based on the TCL data and the sediment screening data was used to define the horizontal extent of contamination in the basin sediments. These data indicate that hexachlorobenzene concentrations (above 2.0 mg/kg) are confined to the southern half of the basin at a maximum concentration of 265 mg/kg. Concentrations were reported below the detection limit in 53 of the 77 basin samples.

Mercury concentrations detected in the grab sediment samples from the sampled ditches within OU-2 were generally lower than those detected in the basin. The ditch sediment sample concentrations ranged from less than the sample detection limit to an estimated concentration of 115 mg/kg Sixteen of the 35 ditch samples showed mercury concentrations less than 1.0 mg/kg. Hexachlorobenzene was detected in 22 of the 25 wastewater ditch grab samples at a maximum concentration of 1,002 mg/kg and an average concentration of approximately 200 mg/kg. Hexachlorobenzene was detected at a maximum concentration of 7.4 mg/kg in the former discharge ditch, near where this ditch intersected the current wastewater ditch. Three of the six samples collected from the former wastewater ditch were reported as not detected. The hexachlorobenzene concentrations ranged from not detected to 970 mg/kg in the current discharge ditch.

The horizontal extents of mercury and hexachlorobenzene in the sediments were not defined by the Phase I and Phase II sampling, and additional sediment sampling was conducted during Phase III. There were a total of 40 Phase III sediment sample locations in the floodplain area and the two ponded areas to the north of the basin. The Phase III samples were analyzed for mercury and hexachlorobenzene. Figure 6 shows the preliminary Phase III sediment results for mercury. The Phase III sampling was conducted at non-flood conditions, and mercury concentrations above 1.0 mg/kg were generally found in the water bodies or within the vicinity of the water bodies. The pattern shown on Figure 6 indicates that mercury concentrations in the floodplain sediments are dependent on the distance from the water bodies (at non-flood conditions), and the data are sufficient to interpret the horizontal extent. Hexachlorobenzene was only reported above the detection limit (0.5 mg/kg) at three locations; two locations to the south (adjacent to the former discharge ditch) and one location in the small pond to the north of the basin. The maximum hexachlorobenzene concentration detected in the Phase III flood plain samples was 8.3 mg/kg in a sample from the small pond. The data are sufficient to interpret the horizontal extent of organic chemicals in OU-2.

A sediment sample was also collected from the Tombigbee River during Phase III, approximately 50 feet from the outlet of the current discharge ditch. Preliminary results indicate that mercury was detected in this river sample at 0.39 mg/kg and hexachlorobenzene was detected at 11.3 mg/kg.

OU-2 Surface Water

A total of 12 surface water samples were collected during the Phase I sampling activities. These samples were collected from discrete depths at randomly selected grid locations in the basin and also from each of the ditches that contained water. The samples were analyzed by CLP procedures for TAL mercury (total and dissolved), the selected list of other TAL constituents, TCL volatile organics, TCL semivolatile organics, and TCL pesticides/PCBs. Non-CLP analyses included dissolved oxygen (DO), pH, TOC, total suspended solids (TSS), and total dissolved solids (TDS).

Only two target organic compounds were reported in the surface water analyses. Chloroform was reported in one sample at an estimated concentration of 3.0 μg/l, below the Contract Required Quantitation Limit (CRQL). Alpha BHC (a pesticide constituent) was reported in two samples at a maximum concentration of 0.22 μg/l. The target analyte results for the 12 surface water samples are summarized below for the total analyses:

TOTAL ANALYSES FOR SURFACE WATER		
Analyte	**Maximum Concentration Reported (ug/l)**	**Number of Samples Analyte Was Detected In**
Arsenic	12.2	2
Cadmium	2.2	2
Chromium	11.1	7
Cyanide	36.9	7
Lead	3.8	3
Mercury	2.8	12
Nickel	45.9	7
Zinc	444	10

Mercury is the dominant inorganic constituent of concern. The potential hazards associated with the reported concentrations of the other TAL constituents are being evaluated as part of the baseline risk assessment.

OU-2 Fish

Twenty specimens of two fish species (largemouth bass and channel catfish) were collected for chemical analyses. Ten whole body samples and 10 filet samples were obtained from each species. The 40 fish samples were analyzed for mercury, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, pentachlorobenzene, hexachlorobenzene, pentachloronitrobenzene,

4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and percent lipids. Total mercury was reported in all of the largemouth bass samples and in all but one of the channel catfish samples. Hexachlorobenzene, chlorobenzene and the chlorinated pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) were also reported in the fish samples.

1.3 SCOPE AND OBJECTIVES

The feasibility study has been underway since the scoping phases of the RI/FS. The amended work plan (May, 1991) identified preliminary remedial action objectives (RAOs) and alternatives. The identification of candidate technologies for OU-2 and the evaluation of whether treatability testing would be required were presented in the candidate technologies technical memorandum (May 14, 1992). A revised remedial action objectives technical memorandum (RRAOTM) was submitted to EPA on April 30, 1992. The RRAOTM presented a list of RAOs based on the preliminary results of the site characterization work and an evaluation of the potential Applicable or Relevant and Appropriate Requirements (ARARs). The RAOs are incorporated herein in Table 5. The scope of this remedial technologies, alternatives screening technical memorandum (RTASTM) is as follows:

- Develop general response actions (GRAs)
- Identify, screen and select remedial technologies and process options; and
- Assemble remedial alternatives.

Future work on the feasibility study will include screening the assembled alternatives based on cost, effectiveness and implementability, and then conducting a detailed analysis of the alternatives that are retained after the screening process.

The candidate technologies technical memorandum, submitted to EPA on May 14, 1992 included the identification of potential candidate technologies for Operable Unit 2. The CTTM also identified whether the potential applicable technologies would require treatability investigations (bench or pilot scale) in order to complete a detailed analysis of the applicability of the technologies for treatment of the affected media. The CTTM was limited to OU-2 because the Phase III sampling planned for OU-1 included samples

likely to affect candidate technologies, whereas OU-2 Phase III samples were only to determine extent. Therefore, a more complete identification and evaluation of OU-1 candidate technologies could be conducted after completion of the Phase III activities.

This memorandum combines the revised CTTM with the RTASTM. The two submittals are combined to allow for evaluation of the Phase III data in order to appropriately select the OU-1 candidate technologies, with minimal impact to the overall RI/FS schedule (J.C. Brown, July 17, 1992). The revised candidate technology list is incorporated as Appendix A. Appendix A also identifies whether the potential applicable technologies would require treatability investigations (bench or pilot scale) in order to complete a detailed analysis of the applicability of the technologies for treatment of the affected media. The combined document is referred to as the RTASTM because the major emphasis is on screening the technologies and process options.

2.0 VOLUME ESTIMATES AND POTENTIALLY AFFECTED MEDIA

This section identifies the potentially affected media and provides volume estimates for the media that may require remedial action to satisfy the RAOs. The FS is being developed concurrently with the RI report and employs a semi-quantitative approach in evaluating the technology types. General volume estimates are provided for potentially affected media; however, these estimates were generated only for the purposes of screening the technologies. As the site characterization and the baseline risk assessment are completed for the RI report, site preliminary remediation goals will be established (where applicable) based on risk-based criteria and ARARs. The media to be addressed and the volume estimates will be refined based on these goals. This information will be incorporated into the draft FS report, which is scheduled to be submitted in January 1993.

The potentially affected media for OU-1, as stated in the RRAOTM, includes groundwater (off-site and on-site), soils, surface water and air/dust emissions. Remedial technologies for addressing on-site groundwater and soils are considered in this technical memorandum. Sampling of area drinking water wells indicated that off-site drinking water has not been impacted above the ARAR and the RAOs for on-site groundwater should prevent any future impact to groundwater off site. Based on the work completed for the baseline risk assessment, the hazards associated with exposure to surface water are characterized as low, indicating that surface water would not require any remedial action to meet the RAOs. The exposure to air/dust emissions is also characterized as low; however, air/dust emissions RAOs will be considered for evaluation of soil remedial alternatives.

The potentially affected media for OU-2 include sediments, groundwater, surface water, fish and game and air/dust emissions. Sediment remedial technologies are screened in this RTASTM. The sediments deposited in the basin and the ditches were identified as the primary source of contamination in OU-2. In addition to sediment RAOs, remediation of the sediment (if required) would be conducted to satisfy the RAOs for the surface water, fish and game and air/dust emissions media. The potential impact

to groundwater in OU-2 is characterized as low based on the sediment and surface water results and the hydrogeologic conditions in the basin, and therefore, groundwater remedial technologies are not considered separately for OU-2.

OU-1 Groundwater

Figure 3 and Figure 4 depict the estimated areal extents of the mercury and organics, respectively. For the purpose of the volume calculations, mercury concentrations above the MCL of 2.0 μg/l are used as the areal extent of affected groundwater, and 50 feet is the estimated saturated thickness of the Alluvial Aquifer. Assuming a porosity of 0.30, the volume of water in the Alluvial Aquifer to be considered for remediation is approximately $1x10^9$ gallons. It should be noted that this estimated in situ volume of affected groundwater is provided for the purpose of screening the technologies and does not represent the total volume of water that would have to be extracted and treated.

The following are the basic findings of the site characterization that are used for development of general response actions and evaluation of groundwater technologies and process options:

- The Alluvial Aquifer has been impacted above the RAOs and is currently being remediated. The existing RCRA corrective action program, which is required by Olin's post-closure permit, is effective at recovering groundwater migrating from any known, past or current sources

- The focus for this technical memorandum is on technologies designed to accelerate the reduction of contaminants. Technologies will also be screened to address the potential secondary source, the mercury-containing brine, in the weak brine pond.

- The Alluvial Aquifer is generally unconfined, composed primarily of sands, and varies in thickness from about 55 to 80 feet in the plant area thinning to less than 40 feet at locations in the west plant area. In the vicinity of the site the average permeability (K) is estimated to be 57

ft/day, the average transmissivity is estimated to be 3,500 ft^2/day, and the specific yield is estimated to be 0.20.

- The primary constituents in the groundwater include mercury, chloroform, chlorobenzene and the dichlorobenzene isomers. Other metals may also have to be addressed for the selected treatment technologies and process options.

In this technical memorandum, the technologies that are evaluated to address contamination in the Alluvial Aquifer are screened as groundwater treatment technologies and process options. These include technologies such as vapor extraction that are commonly categorized as soils treatment. The screening of soils treatment technologies described below is limited to those that address the soils and waste above the Alluvial Aquifer. Capping and other containment technologies that would be implemented above the Alluvial Aquifer are also screened as potential soil technologies.

OU-1 Soils

Based on the preliminary Phase III data that are summarized in Section 1.2, remedial actions are considered for two subsurface soil areas in OU-1: the old plant (CPC) landfill and the area to the west of the former CPC plant. These two areas may be potential continuing sources of groundwater contamination. An initial assessment of the data from the other SWMUs/AOCs that were sampled indicates that remedial actions (beyond the closure and removal activities that have already been conducted in these areas) probably will not be required to meet the soil RAOs. However, further assessment of the OU-1 soils data will be conducted for the draft RI report. This assessment will include an evaluation of the potential soil exposure pathways based on the Phase III data. The draft FS report will include modifications (if any) to the selected technologies/alternatives for OU-1 soils that may be required based on the further assessment.

The volume of fill material mixed with residual waste in the CPC landfill is estimated to be about 30,000 cubic yards (cy), based on an average thickness of 7 feet throughout the landfill. The affected materials in the landfill also include the saturated, loose

silt/clay which is estimated to be approximately 20,000 cy. For screening purposes, about 1 foot of stiff clay (or about 4,500 cy) that underlies the fill/waste and saturated clay/silt is also considered for remedial actions. The Phase III work consisted of four borings across an approximate 2.75 acre area. There may be variations between borings, both in the thickness and in the chemical nature of the materials, that would affect the volume estimates.

For screening purposes, the affected soils to the west of the former CPC plant are assumed to extend northward to the railroad tracks and westward to the road (or about 27,500 square feet). Based on the chemical data and the soil screening results, the constituents are present mainly in the upper 15 feet of soils. Groundwater in this area is generally greater than 30 feet below ground surface. Therefore, because these soils would not be a potential continuing source of contamination to groundwater unless downward percolation passes through them, for the purposes of this technical memorandum, it is presumed that the area will be addressed by extending the existing cap to preclude downward percolation. If further data evaluation suggests that any of the other SWMUs/ACOs that were sampled during Phase III are potential continuing sources of groundwater contamination, capping and/or cap improvement are also potential remedial technologies for addressing these areas.

The following are the basic findings of the CPC landfill soils characterization that are used for development of general response actions and the evaluation of soil treatment technologies and process options.

- The material in the landfill is characterized as silty clay fill that contains residue of waste. Shell rock and wood fragments were encountered, and at one location the landfill material consisted of about six feet of a lime substance.

- The target organic compounds detected in the fill/waste material are dominantly chlorinated benzenes (chlorobenzene, the dichlorobenzene isomers, 1,2,4-trichlorobenzene, 1,2,4,5-tetrachlorobenzene, and hexachlorobenzene). Hexachlorobenzene concentrations in the fill/waste samples ranged from 19 mg/kg to 170 mg/kg, with an average

of 78 mg/kg. The TIC compounds pentachlorobenzene and pentachloronitrobenzene were also reported in the samples. Based on the Phase III analytical results, the fill/waste zone generally contains less than 0.1 percent chlorinated organics.

- Saturation at the base of the fill/waste zone was apparent in each of the borings. At one location, an approximate nine foot zone of very wet, loose silt/clay, with little or no apparent strength, was encountered beneath the fill/waste material. The results of an analysis of this silt/clay were similar to the fill/waste analytical results.

- A stiff, gray, red and brown clay ranging from 3 to 17 feet thick was encountered beneath the fill/waste and saturated zones. Analyses of samples from the base of the clay indicated that volatile organic compounds were more common in the clay than the overlying fill/waste material. The target semivolatile chlorinated benzenes were reported (at concentrations up to 74 mg/kg) in clay samples from the two western borings and were not reported in the clay samples from the two eastern borings.

- The target organics detected in the Alluvial Aquifer material included chlorobenzene, the dichlorobenzene isomers, chloroform, benzene, 1,2,4,5-tetrachlorobenzene, 1,2,4-trichlorobenzene, fluoranthene, and phenol. Similar to the data from the clay samples there are distinct lateral variations in the reported concentrations in the Alluvial Aquifer, with greater concentrations in the western borings than the eastern borings.

- Mercury was detected in three of the four landfill fill/waste samples at concentrations ranging from 21.7 mg/kg to 406 mg/kg. A low mercury concentration (0.42 mg/kg) was reported in the loose silt/clay sample. Mercury was found in only one of the five clay samples at a concentration of 0.62 mg/kg and was not detected in any of the eight Alluvial Aquifer samples.

OU-2 Sediments

For the purposes of screening the technologies, the volume of affected sediments in the basin was estimated at 200,000 cy. This estimate is based on the area of affected sediments (assumed to be the whole basin) multiplied by 1 foot, the estimated nominal depth of affected sediments across the basin. Additional volume was added for consideration of the area near the former wastewater ditch, where mercury and hexachlorobenzene were detected in the deeper sediments. The volume of affected sediments in the ditches is estimated as 15,000 cy based on 6,000 linear feet, 15 feet wide and 4 feet deep. Again, the volume estimates were developed for the purposes of screening the technologies and process option. Risk-based criteria and ARARs will be used to define the volumes required (if any) for remediation.

The following are the basic findings of the site characterization that are used for development of general response actions and the evaluation of sediment treatment technologies and process options:

- Where applicable, the basin and the ditches are addressed separately because treatment technologies that are suitable for one or more of the ditches may not be suitable for the basin. Certain removal and in-situ treatment technologies that may be applicable for the ditches would destroy the biota or its habitat in the basin making these technologies unsuitable for the basin.

- The maximum water depth encountered in the basin was 38.5 feet, with approximately two-thirds of the basin relatively flat with water depth less than 6 feet deep.

- The primary constituents detected in the basin sediments include mercury, chlorinated benzenes (dominantly hexachlorobenzene) and chlorinated pesticides (4'4'-DDT, 4'4'-DDD and 4'4'-DDE). Mercury and the chlorinated pesticides are generally distributed throughout the basin sediments. The chlorinated benzenes are generally in the southern one-third of the basin. The maximum thickness of

contamination in the basin sediment is about 7 feet in the vicinity of the former wastewater ditch.

- Mercury concentrations detected in the grab sediment samples from the sampled ditches were generally lower than those detected in the basin. Sixteen of the 35 ditch samples showed mercury concentrations less than 1.0 mg/kg. Hexachlorobenzene was detected at higher concentrations in the wastewater ditch than in the basin, averaging about 200 mg/kg in the wastewater ditch. The chlorinated pesticides were not as common in the sediments from the wastewater ditch as in those from the basin.

- The surficial sediments in the basin were described as tan, black and dark gray silty clays and clayey silts with occasionally sands. Except for the samples from the few sandy areas (3 of 22 samples) greater than 80 percent of the material passes the No. 200 sieve (silt/clay size). The TOC is generally greater than 10,000 mg/kg due to the natural organic material in the sediments. The water content is commonly greater than 50 percent.

- The sediments in the wastewater ditch were described as a mixture of soft silt and clay and firm to medium sands. The vertical extent of contamination in the wastewater ditch is estimated to be approximately 5 feet.

3.0
DEVELOPMENT OF GENERAL RESPONSE ACTIONS

General response actions are broad classes of actions or remedies that meet remedial action objectives. EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA/540/G-89/004) and Woodward-Clyde's "Candidate Technologies Technical Memorandum" (dated May 14, 1992) were used as the primary resource documents for the chosen General Response Actions (GRAs). The following media-specific GRAs have been identified for this site.

OU-1 GROUNDWATER

- No Action, which consists of leaving the facility "as is" with no provisions being made to increase the present level of groundwater clean-up. It should be noted that the current groundwater remediation activities, which are required by the RCRA Corrective Action Program, would be continued under a "no action" scenario.

- Institutional Controls, which involve the creation and implementation of mechanisms, both physical and legal, that restrict public and environmental contact with the contaminants without addressing actual remediation of the contamination. Typical institutional controls for groundwater include deed restrictions on groundwater usage, alternative water supplies, and groundwater monitoring.

- Containment, which involves physical restrictions on horizontal and vertical groundwater flow, contaminant mobility and surface infiltration.

- Removal, which involves the physical reduction of contamination through extraction of the groundwater.

- Treatment, which involves on-site, off-site and/or in-situ measures to reduce toxicity, mobility and/or volume of the contamination.

- Disposal, which involves discarding contaminated and/or treated groundwater in an approved manner and at an approved site (either on or off site).

OU-1 SOILS

- No Action, which involves leaving the facility "as is" with no provisions for control or clean-up of the contamination.

- Institutional Controls, which involve the creation and implementation of mechanisms, both physical and legal, that restrict public and environmental contact with the contaminants without addressing actual remediation of the contamination. Typical institutional controls for soils include access and deed restrictions.

- Containment, which involves physical actions to isolate contamination from potential exposure and/or restrict contaminant mobility by limiting the possible exposure paths and transport mechanisms.

- Removal, which involves the direct physical removal of the soils through excavation. Removal is commonly conducted in conjunction with soils treatment and/or disposal.

- Treatment, which involves on-site, off-site and/or in-situ measures to reduce toxicity, mobility and/or volume of the contamination in the soils.

- Disposal, which involves discarding contaminated soils and/or treatment residuals in an approved manner and at an approved site (either on or off site).

OU-2 SEDIMENTS

- No Action, which involves leaving the facility "as is" with no provisions for control or clean-up of the contamination.

- Institutional Controls, which involve the creation and implementation of mechanisms, both physical and legal, that restrict public and environmental contact with the contaminants without addressing actual remediation of the contamination. Typical institutional controls for the sediments include access and deed restrictions and may also include fishing restrictions.

- Containment, which involves physical mechanisms to isolate contamination from potential exposure and/or restrict contaminant mobility.

- Removal, which involves the direct physical removal of the affected sediments. Removal is commonly conducted in conjunction with sediment treatment and/or disposal.

- Treatment, which involves on-site, off-site and/or in-situ measures to reduce toxicity, mobility and/or volume of the contamination in the sediments.

- Disposal, which involves discarding contaminated sediments or treatment residuals in an approved manner and at an approved site (either on or off site).

Table 5 summarizes these potentially affected media, RAOs and GRAs for the two operable units at the Olin facility.

4.0

EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

Potential technologies and process options to be used for development of the remedial alternatives are selected based on the site characterization data and the media-specific general response actions that are presented in Section 3.0. This section describes the screening and evaluation of remedial technologies and process options, which is conducted as follows:

- Identification of Remedial Technologies and Process Options;
- Screening of Remedial Technologies and Process Options;
- Evaluation of Process Options based on Effectiveness, Implementability, and Cost; and
- Selection of Remedial Technologies and Process Options.

These activities are described below in more detail.

4.1 IDENTIFICATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

The technologies and process options screened in this section are based on the list of candidate technologies in Appendix A. The OU-2 (sediment) technologies and process options in Appendix A are based on the list of technologies provided in the CTTM. As suggested by EPA in their July 14, 1992, comments on the CTTM, further streamlining of this list was conducted prior to the initial screening based on the GRAs and additional evaluation of the site characterization data and further details of the technologies. The term remedial technology refers to general categories of technology types, such as biological treatment, chemical treatment, and thermal destruction. The term process option refers to specific processes within each technology category. For example, under the technology category of biological treatment, there may be aerobic

and anaerobic treatment process options. The technologies and process options were assembled after review of:

- EPA guidance documents;
- EPA's Alternative Treatment Technology Information Center (ATTIC) database;
- Pertinent technical journals and seminar/conference proceedings;
- EPA's Vendor Information System for Innovative Treatment Technologies (VISITT Version 1.0, June 1992);
- EPA's Cleanup Information Bulletin Board (CLU-IN, April 1991);
- Information provided by equipment/process vendors and remediation contractors; and
- WCC's past experience in the hazardous waste remediation area.

Some of the key EPA guidance documents used in this review are:

- Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA/540/G-89/004; October. 1988 - Interim Final); and
- Guide to Treatment Technologies for Hazardous Wastes at Superfund Sites (USEPA, 1989b).

Tables 6, 7, and 8 list the potential treatment technologies and corresponding process options for OU-1 Groundwater, OU-1 Soils, and OU-2 Sediments, respectively.

Any of the direct waste treatment technologies (i.e., treatment after removal) for Operable Unit 2, will require treatment of process water due to the high water content

of the sediment. Depending on the type of treatment, Operable Unit 1 technologies for soil may also require process water treatment. Similarly, the sediment and soil treatment technologies may require dewatering or different types of solids processing such as debris removal, screening, grinding or other process to make the material acceptable for treatment. While the process water and solids processing steps are critical in the effective implementation of the treatment technologies, they are not screened in this memorandum because they are not considered critical in the selection of the applicable process options. Further consideration will be give to process water and process solids during the detailed analysis of the alternatives.

4.2 SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

The remedial technologies and process options identified in Tables 6 through 8 were first screened on the basis of technical implementability, in accordance with EPA's guidance for performing feasibility studies (U.S. EPA, 1988).

The technologies and the process options that cannot be effectively implemented at the facility were screened out by using the information currently available from the RI site characterization, such as contaminant types, contaminant concentrations, and site characteristics. Tables 6, 7, and 8 describe the process options, present initial screening comments, and summarize the technology screening process. A description of each process option is included in the tables to provide an understanding of each option and to assist in the evaluation of its technical implementability. The screening comments address the technical feasibility and ability of a given process option to serve its intended purpose. The tables include a statement as to whether each process option is retained or screened out.

4.3 EVALUATION OF PROCESS OPTIONS BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

The process options that were retained for evaluation during the initial screening are evaluated in greater detail. The evaluation criteria are effectiveness, implementability, and cost, in accordance with EPA's guidance on conducting feasibility studies (U.S. EPA 1988). As mentioned in Section 1.0 of this memorandum, in the absence of detailed

information on the volumes and the target cleanup levels, a semi-quantitative approach was employed in evaluating the technology types and process options using volume estimates that may be revised at a later date and assumed target clean-up levels.

Process options were evaluated based on their effectiveness relative to other options within the same technology type. This evaluation focused on three primary considerations:

- The potential effectiveness of process options in handling each medium and meeting the goals identified in the general response actions;
- The effectiveness of the process options in protecting human health and the environment during the construction and implementation phases; and
- The proven track record and the reliability of the process options with respect to the contaminants and conditions at the Facility.

The implementation evaluation includes consideration of both the technical and the administrative feasibility of implementing a particular process option.

The cost evaluation includes a qualitative estimation of the relative capital and operation and maintenance (O&M) costs within the same technology type, associated with the process options. It should be noted that the greatest cost variability during site remediation is generally seen within the technology types, rather than within specific process options in a given technology.

The evaluation of the process options is summarized in Tables 9 through 11 for OU-1 groundwater, OU-1 soils, and OU-2 sediments, respectively. The process options retained after the evaluation are used in the development of the remedial alternatives, presented in Section 5.0. The rejected process options are eliminated from further consideration.

5.0
DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

Remedial alternatives were developed to provide a range of cleanup options to address the RAOs for the potentially affected media. These alternatives were assembled from the retained technology types and process options in Section 4.0 for OU-1 groundwater, OU-1 soils and OU-2 sediments.

5.1 ASSEMBLED OU-1 GROUNDWATER ALTERNATIVES

Groundwater Alternative A - No Action With Continuation of Existing CAP

Alternative A is the no action alternative with continuation of the existing groundwater corrective action program (CAP). The CAP, which is a requirement of Olin's post-closure RCRA permit, has been operating since 1987 and has proven to be effective at recovering groundwater from all know past and present sources. For the purpose of evaluation, this alternative will be the baseline for comparison of the other groundwater alternatives. Any groundwater alternative would be implemented in conjunction with the existing CAP.

Groundwater Alternative B - Institutional Actions

Alternative B consists of implementing institutional controls. The institutional controls that were retained in Section 4.0 include additional groundwater monitoring of on-site and off-site wells, and deed restrictions on surrounding property that would restrict groundwater usage. These institutional controls would be implemented to limit the potential exposure to receptors, and would not reduce the toxicity, mobility or volume of contaminants.

Groundwater Alternatives C1 through C3 - Extraction/Treatment/Discharge

Alternatives C1 through C3 consist of extraction, treatment and discharge of contaminated groundwater. The three alternatives are modifications of the existing CAP

to accelerate contaminant reduction. Alternative C1 consists of installing and operating additional extraction wells in the interior portions of the mercury and organic plumes. Alternative C2 includes installing injection and extraction wells. Alternative C3 consists of installing horizontal extraction wells at the base of the Alluvial Aquifer in the vicinity of the weak brine pond to expedite removal of the dense brine.

The primary groundwater treatment process options retained in Section 4.0 that will be considered for alternatives C1 through C3 include the following

- Precipitation - for removal of mercury and other inorganic constituents
- Carbon Adsorption - for removal of mercury and the organic constituents
- Air and steam stripping - for removal of volatile organics and selected semivolatile constituents

Other process options were retained and will be considered for pretreatment of the groundwater in conjunction with one or more of the primary treatment options listed above. The treated water would be discharged through Olin's existing NPDES system.

Groundwater Alternative D - Enhanced Extraction/Treatment/Discharge

Alternative D consists of enhanced extraction using steam injection to be implemented in conjunction with the existing CAP, or a modification of the existing CAP. The steam injection system would be installed in localized areas for removal of the organics from the sands of the unsaturated and saturated zones. The recovered steam would either be condensed and treated with the groundwater or treated with gas-phase activated carbon.

5.2 ASSEMBLED OU-1 SOIL ALTERNATIVES

The assembled OU-1 soil remedial alternatives are summarized in this section.

Soil Alternative A - No Action

Alternative A is the no action alternative. This alternative would allow the OU-1 soils to remain as they currently exist with no provisions for reduction in contaminant toxicity, mobility or volume. Evaluation of the no action alternative provides a baseline for comparison with the other alternatives.

Soil Alternative B - Institutional Actions

Alternative B includes implementation of additional institutional controls. Institutional controls related to OU-1 soils that already exist at the facility include:

- Access to the plant is restricted by fencing and a guarded main entrance.
- The deed for the McIntosh property has a statement regarding the presence of hazardous waste on site.
- Quarterly groundwater monitoring is conducted for the RCRA compliance and corrective action programs.

Alternative B includes increased groundwater monitoring in the vicinity of the former CPC landfill.

Soil Alternative C - Containment

Alternative C consists of improving the existing cap over the former CPC landfill to reduce the mobility of the constituents. Clay and multi-media caps will be considered.

Soil Alternative D - In situ Stabilization/Containment

Alternative D consists of in situ stabilization of the CPC landfill fill/waste and underlying affected materials to decrease the mobility of the constituents. After

stabilization, the stabilized area would then be capped. Both clay and multi-media caps will be considered.

Soil Alternative E - Excavation/Stabilization/Containment

Alternative E consists of excavating the former CPC landfill fill/waste and underlying affected materials, stabilizing the material after excavation to reduce the mobility, and containment of the stabilized material. Clay and/or synthetic liners, installed in the excavation, will be considered for containment. The stabilized material would be covered by either a clay or multi-media cap.

Soil Alternative F - Excavation/Off-site RCRA Disposal

Alternative F consists of excavating the former CPC landfill fill/waste and underlying affected materials, and off-site disposal at a commercial hazardous waste landfill.

Soil Alternatives G1 and G2 - Excavation/On-site Thermal Treatment/Disposal

Alternatives G1 and G2 both consist of excavating the former CPC landfill fill/waste and underlying affected materials, and on-site thermal treatment using one of the following process options:

- Circulating Bed Combuster
- Rotary Kiln Incinerator
- Infrared Incinerator
- Thermal Desorption

No prior treatment would be conducted with Alternative G1. Alternative G2 includes prior treatment of the material using acid extraction to separate the mercury. The two alternatives could be used for different fractions of the excavated material depending on the mercury content. Both on-site and off-site disposal options will be considered for the residuals from the acid extraction and the thermal processes. The acid extraction residuals would be stabilized prior to disposal.

Soil Alternatives H1 and H2 - Excavation/Chemical Extraction or Dechlorination/Disposal

Alternatives H1 and H2 consist of excavating the former CPC landfill fill/waste and underlying affected materials, and treating the material using one of the following on-site chemical extraction or dechlorination methods:

- BEST℠
- Liquified Gas
- LEEP℠
- APEG-PLUS™

Alternative H1 would include acid extraction prior to the chemical extraction/dechlorination process to separate the mercury. Alternative H2 would include disposal of the material from the chemical extraction/dechlorination process without mercury removal. The two alternatives could be used for different fractions of the excavated material depending on the mercury content. Both on-site and off-site disposal options will be considered for the treated soil and the treatment residuals. Stabilization of the acid extraction residuals would be required prior to disposal.

Soil Alternatives I1 and I2 - Excavation/Off-site Incineration

Alternatives I1 and I2 consist of excavating the former CPC landfill fill/waste and underlying affected materials, and transporting the excavated material to a commercial incinerator. Alternative I1 is off-site incineration without on-site treatment for mercury. Alternative I2 includes acid extraction prior to incineration. The two alternatives could be used for different fractions of the excavated material depending on the mercury content. Both on-site and off-site disposal options will be considered. Stabilization of the acid extraction residuals would be required prior to disposal.

5.3 ASSEMBLED OU-2 SEDIMENT ALTERNATIVES

The assembled alternatives for OU-2 sediments are summarized in this section. Because of the different conditions in the basin and the wastewater ditch, these areas are considered separately for some of the alternatives.

OU-2 Sediment Alternative A - No Action

Alternative A is the no action alternative. This alternative would allow the OU-2 sediments to remain as they currently exist with no provisions for reduction in toxicity, mobility or volume of the contaminants. Evaluation of the no action alternative provides a baseline for comparison with the other alternatives.

OU-2 Sediment Alternative B - Institutional Actions

Alternative B includes implementation of institutional controls to reduce the potential exposure to contaminated fish and sediments. These controls include sediment and fish monitoring, extension of existing fencing to limit access, and increased enforcement of fishing restrictions.

5.3.1 Basin Sediments

OU-2 (Basin) Sediment Alternative C - Dredging/Disposal

Alternative C for the basin includes dredging the basin sediments and disposal. Mechanical and hydraulic dredging methods will be considered for this alternative and the other basin dredging alternatives. Due to the variations in the concentrations throughout the basin, the type of disposal (RCRA/non-RCRA and on-site/off-site) may be dependent on where the sediments are removed from the basin. On-site dewatering of the sediments would be required prior to disposal.

OU-2 (Basin) Sediment Alternative D - Dredging/Acid Extraction/Disposal

Alternative D includes dredging the basin sediments, acid extraction to remove the mercury and disposal. The acid extraction residuals would be stabilized and disposed. Disposal options (for the dredged basin sediments and the residuals) that will be considered include off-site (RCRA and non-RCRA) and on-site placement. On-site dewatering of the sediments would be required.

OU-2 (Basin) Sediment Alternative E - Dredging/Acid Extraction/Chemical Extraction or Dechlorination/Disposal

Alternative E consists of dredging the basin sediments, acid extraction to remove the mercury and one of the following chemical extraction/dechlorination methods to remove the organics:

- BEST®
- Liquified Gas
- LEEP℠
- APEG-PLUS™

Alternative E could be used in conjunction with Alternative D depending on the concentrations of chlorinated organics in the sediments (i.e., all of the dredged sediments may not require removal of organics). Both on-site and off-site disposal options will be considered for the treated sediment and the treatment residuals. Stabilization of the acid extraction residuals would be required prior to disposal.

OU-2 (Basin) Sediment Alternative F - Dredging/Acid Extraction/On-site Thermal Treatment/Disposal

Alternative F consists of dredging the basin sediments, acid extraction to remove the mercury followed by one of the following thermal processes:

- Circulating Bed Combuster
- Rotary Kiln Incinerator

- Infrared Incinerator
- Thermal Desorption

Alternative F could be used in conjunction with Alternative D depending on the concentrations of chlorinated organics in the sediments. Disposal of residuals from both the acid extraction and the thermal treatment processes would be required. Both on-site and off-site disposal options will be considered. The acid extraction residuals would be stabilized prior to disposal.

OU-2 (Basin) Sediment Alternative G - Dredging/Acid Extraction/Off-site Incineration

Alternative G includes dredging of the basin sediments, acid extraction to remove the mercury and off-site incineration. Alternative G could be used in conjunction with Alternative D depending on the concentrations of chlorinated organics in the sediments. Stabilization of the acid extraction residuals would be required prior to disposal. Both on-site and off-site disposal options will be considered.

5.3.2 Wastewater Ditch Sediments

OU-2 (Wastewater Ditch) Sediment Alternative C - Containment

Alternative C includes capping of the ditch sediments to prevent sediment transport down the wastewater ditch. Asphalt, concrete, and other erosion control capping options will be considered.

OU-2 (Wastewater Ditch) Sediment Alternative D - Stabilization/Containment

Alternative D includes stabilization of the ditch material, either in situ or by excavation/mixing and placement back in the excavation. The material would then be capped to prevent erosion. Asphalt, concrete, and other erosion control capping options will be considered.

OU-2 (Wastewater Ditch) Sediment Alternative E - Excavation/Disposal

Alternative E includes excavation of the wastewater ditch sediments and off-site disposal at a hazardous waste landfill. Due to the variations in sediment concentrations in the ditch, the type of disposal (RCRA/non-RCRA and on-site/off-site) may be dependent on where the sediments are removed from the wastewater ditch. On-site dewatering of the sediments would be required prior to disposal.

OU-2 (Wastewater Ditch) Sediment Alternatives F1 and F2 - Excavation/Chemical Extraction or Dechlorination/Disposal

Alternatives F1 and F2 consist of excavating the wastewater ditch sediments and treating the material using one of the following on-site chemical extraction or dechlorination methods:

- BEST®
- Liquified Gas
- LEEP℠
- APEG-PLUS™

Alternative F1 would also include treatment of the material using acid extraction to separate the mercury. Alternative F2 would include disposal of the material from the chemical extraction or dechlorination process. The two alternatives could be used for different fractions of the excavated material depending on the mercury content. Both on-site and off-site disposal options will be considered for the treated sediment and the treatment residuals. Stabilization of the acid extraction residuals would be required prior to disposal.

OU-2 (Wastewater Ditch) Sediment Alternatives G1 and G2 - Excavation/On-site Thermal Treatment/Disposal

Alternatives G1 and G2 both consist of excavating the wastewater ditch sediments and on-site thermal treatment using one of the following process options:

- Circulating Bed Combuster
- Rotary Kiln Incinerator
- Infrared Incinerator
- Thermal Desorption

No prior treatment would be conducted with Alternative G1. Alternative G2 includes prior treatment of the material using acid extraction to separate the mercury. The two alternatives could be used for different fractions of the excavated material depending on the mercury content. Both on-site and off-site disposal options will be considered for the residuals from both the acid extraction and the thermal processes. Stabilization of the acid extraction residuals would be required prior to disposal.

OU-2 (Wastewater Ditch) Sediment Alternatives H1 and H2 - Excavation/Acid Extraction/Off-site Incineration

Alternatives H1 and H2 consist of excavating the wastewater ditch sediments and transporting the excavated material to an off-site commercial incinerator. Alternative H1 is off-site incineration without on-site treatment for mercury. Alternative H2 includes acid extraction prior to incineration. The two alternatives could be used for different fractions of the excavated material depending on the mercury content. Stabilization of the acid extraction residuals would be required prior to disposal. Both on-site and off-site disposal options will be considered.

5.4 FUTURE EVALUATION OF ASSEMBLED ALTERNATIVES

The assembled alternatives will be evaluated as part of the feasibility study. An initial screening will be conducted based on cost, effectiveness and implementability. A detailed evaluation will then be performed for the alternatives that are retained from the initial screening. Although this memorandum defines specific alternatives assembled from retained technologies and process options, these alternatives are subject to change as the RI/FS progresses. Treatability studies will better define the applicability of the process options to site conditions. Alternatives may be modified as the clean-up criteria are established and the areas requiring remediation are defined.

6.0
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TABLES

SUMMARY OF TCL AND TAL CONSTITUENTS DETECTED IN THE GROUNDWATER SEPTEMBER 1991 SAMPLING

TCL Results			TAL Results		
Analyte	Maximum Concentration Reported (µg/l)	Number of Wells Where Analyte Was Detected[1]	Analyte	Maximum Concentration Reported (µg/l)	Number of Wells Where Analyte Was Detected[1]
TCL Volatile Organics					
1,1,1-Trichloroethane	5J	1	Antimony	2120J[2](B)	1
1,1-Dichloroethane	3J	1	Arsenic	32.7J[2]	7
1,1-Dichloroethene	5J	1	Beryllium	115J[2](B)	20
2-Butanone	220	5	Cadmium	95	4
Benzene	350	6	Chromium	719	19
Bromodichloromethane	65	7	Copper	3430J[2]	5
Bromoform	31	3	Lead	252	27
Carbon Tetrachloride	8J	1	Mercury	146	18
Chlorobenzene	2,500	17	Nickel	1310	12
Chloroform	1,200	17	Selenium	31.9J[2]	1
Dibromochloromethane	40	5	Silver	40.2	4
			Thallium	-	0
TCL Semivolatile Organics			Zinc	3060J[2]	27
1,2,4-Trichlorobenzene	220	11	Cyanide	350J[3]	7
1,2-Dichlorobenzene	4,000	15			
1,3-Dichlorobenzene	270	9			
1,4-Dichlorobenzene	4,100	15			
2,4-Dichlorophenol	59	3			
2-Chlorophenol	80	3			
Phenol	3J	1			
TCL Pesticides/PCB					
Alpha-BHC	5.60	14			
Beta-BHC	2.20	12			
Delta-BHC	.57	7			
Gamma-BHC	1.00	9			
Gamma-Chlordane	.20	1			

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TABLE 1 (Continued)

SUMMARY OF TCL AND TAL CONSTITUENTS DETECTED IN THE GROUNDWATER SEPTEMBER 1991 SAMPLING

NOTES:

J = Estimated concentration below the quantitation limit.
[1] = A total of 33 wells were sampled in September 1991.
(B) = Reported value is less than the sample specific Contract Required Detected Limit.
J[2] = Matrix spike recovery outside control limits. Concentration is estimated.
J[3] = Missing raw data and non-CLP quantitation limit. Concentrations and detection limits are estimated.

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TABLE 2

SUMMARY OF DOMESTIC WELL ANALYTICAL RESULTS
NOVEMBER 1991 SAMPLING

Well Location												
Concentrations in µg/l												
Detected Analyte	**DW-07**	**DW-08**	**DW-12**	**DW-20**	**DW-25**	**DW-26**	**DE-27**	**DW-34**	**DW-35a**	**DW-39a**	**DW-40**	**DW-42(A)**
Chloroform		0.2J	0.3J			13	1J	1J	2	8		0.2J
Chlorobenzene				0.2J								
Tetrachloroethene	0.3J											
1,1,2,2-Tetrachloroethane					0.3J							
Mercury											0.37	

NOTES:

A total of 34 drinking water wells were sampled; only detected values are shown. Does not include values qualified as "U" based on data validation.
Domestic well locations are shown on Figure 22 of the Preliminary Site Characterization Summary (April 16, 1992).
J = Estimated concentration below the validated quantitation limit.

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SUMMARY OF PRELIMINARY PHASE III DATA
PHASE III SAMPLING
OLD PLANT (CPC) LANDFILL

Parameter[1]	Fill/Waste Material		Base of Clay		Alluvial Aquifer		Loose Silt/Clay Sample at BOP1
	Concentration Range (mg/kg)	Number of Detections Out of Four Samples	Concentration Range (mg/kg)	Number of Detections Out of Five Samples	Concentration Range (mg/kg)	Number of Detections Out of Eight[2] Samples	Concentration (mg/kg)
VOLATILE ORGANICS							
1,1,1-Trichloroethane	--[3]	0	--	0	0.530J	1	--
Benzene	--	0	0.009J-3.3	3	2.3	1	2.4
Chlorobenzene	0.004J[4]-9.7	4	0.007J-7.3	5	0.001J-46	4	60
Chloroform	0.009J	1	0.004J-0.16	3	0.004J-0.033	2	0.37J
Tetrachloroethene	--	0	--	0	--	0	0.20J
SEMIVOLATILE ORGANICS							
1,2,4,5-Tetrachlorobenzene	0.15J-32	4	0.22J	1	0.67-4.1	3	30
1,2,4-Trichlorobenzene	0.75-20	3	0.71J	1	0.79-4.6	3	30
1,2-Dichlorobenzene	2.1J-110	3	1.8-57	2	6.4-130	3	120
1,3-Dichlorobenzene	0.16J-6.6	3	5.0	1	0.15J-11	3	7.1
1,4-Dichlorobenzene	2.7-120	3	2.2-74	2	8.5-150	3	120
2-Chlorophenol	--	0	0.44J	1	--	0	--
Fluoranthene	0.42J	1	--	0	--	0	--
Hexachlorobenzene	13-170	4	0.40J	1	0.24J-1.2	3	140
Naphthalene	2.6J	1	--	0	--	0	--
Phenanthrene	0.41J	1	--	0	--	0	--
Phenol	--	0	2.9-3.7	2	5.2-11	2	3.1
Pyrene	0.44J	1	--	0	--	0	--

NOTES:

1. Only target volatile and semivolatile compounds that were detected are listed.
2. Includes two samples from each boring. Where a duplicate sample was obtained, the maximum concentration from either the original or duplicate sample is used.
3. -- Not detected.
4. J - estimated concentration below the quantitation limit.

TABLE 4

SUMMARY OF PHASE I TCL AND TAL RESULTS
OPERABLE UNIT 2 SEDIMENT GRAB SAMPLES
AUGUST 1991 SAMPLING

TCL Results			TAL Results		
Analyte	Number of Grab Samples Out of 21 Where Analyte Was Detected	Maximum Concentration Detected in Grab Sample (mg/kg)	Analyte	Number of Grab Samples Where Analyte Was Detected[1]	Maximum Concentration or Maximum Detection Limit (mg/kg)
TCL Volatile Organic					
Chlorobenzene	20	1.0	Antimony	4[3]	24.6
			Arsenic	21	16.1
TCL Semivolatile Organics			Beryllium	0	3.7
1,2,4-Trichlorobenzene	1	1.1	Cadmium	0	1.52U[5]
1,2-Dichlorobenzene	1	0.24	Chromium	21	52.1
1,3-Dichlorobenzene	4	0.95	Copper	20	57.5
1,4-Dichlorobenzene	5	0.63	Lead	21	44.2
Hexachlorobenzene	10[2]	810	Mercury	109	290
			Nickel	0	27.9U[5]
TCL Pesticides/PCB			Selenium	0	6.7U[5]
4,4'-DDD	20	1.8	Silver	0[4]	1.36U[5]
4,4'-DDE	20	1.4	Thallium	0[6]	2.19U[5]
4,4'-DDT	18	4.0	Zinc	21	227
Aldrin	1	0.028	Cyanide	6	1.5
Alpha-BHC	2	0.014			
Beta-BHC	4	0.018			
Delta-BHC	2	0.170			
Endosulfan I	1	0.110			
Endosulfan II	1	0.051			
Gamma-BHC	1	0.029			
Heptachlor Epoxide	2	0.017			

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TABLE 4 (Continued)

SUMMARY OF PHASE I TCL AND TAL RESULTS
OPERABLE UNIT 2 SEDIMENT GRAB SAMPLES
AUGUST 1991 SAMPLING

NOTES:

1. Total of 21 grab samples collected for all analytes except mercury. There were 112 grab samples for mercury.
2. Does not include sediment screening analyses.
3. Thirteen samples and one duplicate sample that were reported as not detected were rejected during data validation due to insufficient matrix spike sample recovery.
4. Twelve samples and two duplicate samples that were reported as not detected were rejected during data validation due to insufficient recovery from the interference check sample.
5. Analyte was not detected in any of the grab samples. The maximum detection limit is given.
6. Seventeen samples and one duplicate that were reported as not detected were rejected during data validation due to insufficient spike sample recovery.

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TABLE 5

ENVIRONMENTAL MEDIA, REMEDIAL ACTION OBJECTIVES, AND GENERAL RESPONSE ACTIONS FOR OU-1 AND OU-2

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)
Groundwater (Operable Unit 1)	**For human health** - Prevent ingestion/direct contact with water having contaminant concentrations with a cumulative cancer risk in excess of $1x10^{-04}$ to $1x10^{-06}$ or a cumulative Hazard Index greater than 1. **For environmental protection** - Prevent further degradation of the aquifer. Restore groundwater quality to appropriate ARARs.	No action with continuation of the existing RCRA CAP Institutional Actions Containment Actions Removal/Treatment/Disposal Actions: Removal/treatment/disposal In situ treatment
Soils (Operable Unit 1)	**For human health** - Prevent ingestion/direct contact with soils having contaminant concentrations with a cumulative cancer risk in excess of $1x10^{-04}$ to $1x10^{-06}$ or a hazard index greater than 1. **Environmental Protection** - Prevent migration of contaminants that would result in groundwater contamination in excess of groundwater remediation goals	No Action Institutional Actions Containment Actions Removal/Treatment/Disposal Actions: Removal/disposal Removal/treatment/disposal In situ treatment
Surface Water (Operable Unit 1)	**For human health** - Prevent ingestion/direct contact with surface water having contaminant concentrations with a cumulative cancer risk of $1x10^{-04}$ to $1x10^{-06}$ or a cumulative Hazard Index greater than 1. **For environmental protection** - Prevent contamination in excess of surface water remediation goals.	Based on the work completed for the baseline risk assessment, the hazards associated with exposure to surface water are characterized as low indicating that surface water would not require any response action to meet the RAOs.

TABLE 5 (Continued) 3 8 1321

ENVIRONMENTAL MEDIA, REMEDIAL ACTION OBJECTIVES, AND GENERAL RESPONSE ACTIONS FOR OU-1 AND OU-2

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)
Air Dust Emissions (Operable Unit 1)	**For human health -** Prevent direct contact and ingestion of contaminated dust from the site having contaminant concentrations with a cumulative cancer risk in excess of $1x10^{-04}$ to $1x10^{-06}$ or a cumulative hazard index greater than 1. **For environmental protection -** Prevent the release of contaminated dust to be carried by wind to nearby receptors whereby exposure may occur through food ingestion pathways.	Specific GRAs are not listed for air/dust emissions. Air/dust emissions RAOs will be considered for evaluation of soil remedial alternatives.
Sediment (Operable Unit 2)	**For human health -** Prevent direct contact with sediments having contaminant concentrations with a cumulative cancer risk of $1x10^{-04}$ to $1x10^{-06}$ or a cumulative Hazard Index greater than 1. **For the environment -** Prevent contaminant releases from the ditch and basin sediments that cause exceedences of surface water remediation goals or fish and game health-based standards or action levels	No Action Institutional Actions: Containment Actions: Removal/Treatment/Disposal Actions: Removal/disposal Removal/treatment/disposal In situ treatment
Surface Water (Operable Unit 2)	**For human health -** Prevent ingestion/direct contact with surface water having contaminant concentrations with a cumulative cancer risk of $1x10^{-04}$ to $1x10^{-06}$ or a cumulative Hazard Index greater than 1. **For environmental protection -** Prevent contamination in excess of surface water remediation goals. Prevent contaminant releases from surface water that cause exceedences of fish and game health-based standards or action levels.	Specific GRA are not listed for surface water. Surface water RAOs will be considered in the evaluation of sediment remedial alternatives.

TABLE 5 (Continued)

ENVIRONMENTAL MEDIA, REMEDIAL ACTION OBJECTIVES, AND GENERAL RESPONSE ACTIONS FOR OU-1 AND OU-2

Environmental Media	Remedial Action Objectives (RAOs)	General Response Actions (GRAs)
Fish and game (Operable Unit 2)	**For human health -** Prevent ingestion of fish and game having contaminant concentrations with a cumulative cancer risk in excess of $1x10^{-04}$ to $1x10^{-06}$ or a cumulative Hazard Index greater than 1. **For environmental protection -** Prevent ingestion of contaminated fish and game by higher trophic levels to exceed fish and game health-based standards or action levels.	Specific GRAs are not listed for fish and game. Fish and game RAOs will be considered in the evaluation of sediment remedial alternatives.
Air Dust Emissions (Operable Unit 2)	**For human health -** Prevent direct contact and ingestion of contaminated dust from the site having contaminant concentrations with a cumulative cancer risk in excess of $1x10^{-04}$ to $1x10^{-06}$ or a cumulative hazard index greater than 1 **For environmental protection -** Prevent the release of contaminated dust to be carried by wind to nearby receptors whereby exposure may occur through food ingestion pathways.	Specific GRAs are not listed for air/dust emissions. Air/dust emissions RAOs will be considered for evaluation of sediment remedial alternatives.

TABLE 6

INITIAL SCREENING OF TECHNOLOGIES TYPES AND PROCESS OPTIONS FOR GROUNDWATER IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
No action, with continuation of the existing RCRA corrective action program (CAP)	Continuation of the existing RCRA CAP	Continuation of the existing RCRA CAP	Retained	Required for evaluation	
Constitutional Action	Access restriction	Fencing: Fencing the site from potential contaminant exposure	Screened out	Not applicable to groundwater contamination.	7
Institutional Action	Access restriction	Deed restrictions: Deeds for property in the area of influence would include restriction on wells	Retained	Potentially applicable.	7
Institutional Action	Alternative residential water supply	Water supply from deeper aquifer: Water supply to area residents by installation of Miocene Aquifer wells.	Screened out	No off-site drinking water wells have been impacted by the plume above ARARs.	7
Institutional Action	Alternative residential water supply	Municipal water supply: Supply of McIntosh city water to area residents	Screened out	No off-site drinking water wells have been impacted by the plume above ARARs.	7
Institutional Action	Monitoring	Groundwater monitoring: Monitoring of on-site and off-site area wells	Retained	Potentially applicable	7

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TABLE 6 (Continued)

INITIAL SCREENING OF TECHNOLOGIES TYPES AND PROCESS OPTIONS FOR GROUNDWATER IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Containment Actions	Capping	Clay cap: Compacted clay covered with soil over areas of contamination	Screened out	Known or suspected source areas have already been capped.	7
Containment Actions	Capping	Asphalt: Spray application of a layer of asphalt	Screened out	Known or suspected source areas have already been capped.	7
Containment Actions	Capping	Concrete: Installation of concrete slabs over areas of contamination	Screened out	Known or suspected source areas have already been capped.	7
Containment Actions	Capping	Multimedia cap: Clay and synthetic membrane covered by soil over areas of contamination	Screened out	Known or suspected source areas have already been capped.	5
Containment Actions	Vertical barriers	Sheet piling: Sheet piles act as low-permeability subsurface barrier walls that either contain, capture, or redirect groundwater flow at the site. Sheet piles can be made of wood, pre-cast concrete, or steel. Steel piles are the most effective in terms of groundwater cut-off and cost.	Retained	Potentially applicable.	5
Containment Actions	Vertical barriers	Slurry walls: Slurry walls act as low-permeability subsurface barrier walls that either contain, capture, or redirect groundwater flow at the site. Soil-bentonite slurry walls are the most common slurry walls. Less common are the cement-bentonite and/or concrete (diaphragm) walls.	Retained	Potentially applicable	5

TABLE 6 (Continued)

INITIAL SCREENING OF TECHNOLOGIES TYPES AND PROCESS OPTIONS FOR GROUNDWATER IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Containment Actions	Vertical barriers	Grouting: A process whereby one of a variety of fluids is injected into a rock or soil mass where it is set in place to reduce water flow and strengthen the formation. Grouting includes such technologies as rock grouting, and grout curtains.	Screened out	Has not yet been proven to be effective and reliable for hazardous waste sites. Other vertical barriers like slurry walls are preferred.	5
Containment Actions	Horizontal barriers	Grout injection: Drilling through the site and injecting a grout to form a horizontal or curved barrier to prevent the downward migration of contaminants	Screened out	Innovative technology; not considered applicable for Alluvial Aquifer due to depth of contamination	5
Containment Actions	Horizontal barriers	Block displacement: Displacement and bottom sealing of a block of earth isolated by perimeter barriers, by continued grout or slurry pumping to prevent the downward migration of contaminants	Screened out	Innovative technology; not considered applicable for Alluvial Aquifer due to depth of contamination	5
Removal Actions	Subsurface drains	Interceptor drain: Any conduit buried underground to collect and convey aqueous discharges by gravity flow. Manholes or wet wells are used to collect the flow conveyed by the conduits and pump the discharge aboveground to the treatment system	Retained	Potentially applicable.	5

TABLE 6 (Continued)

INITIAL SCREENING OF TECHNOLOGIES TYPES AND PROCESS OPTIONS FOR GROUNDWATER IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Removal Actions	Extraction	Additional extraction wells: Installation of additional extraction wells to accelerate contaminant reduction.	Retained	Potentially applicable: The alluvial aquifer conditions (transmissivity, specific yield, permeability, etc) are favorable for the application of this technology. Groundwater pump and treat is part of the ongoing RCRA CAP.	5
Removal Actions	Extraction	Extraction with injection wells: Installation of injection wells to accelerate contaminant reduction.	Retained	Potentially applicable.	
Removal Actions	Extraction	Horizontal wells: An innovative technology in which wells are installed horizontal. Can have greater lateral influence than conventional extraction wells. Would be installed to accelerate contaminant reduction either as groundwater extraction or vapor extraction wells.	Retained	Potentially applicable for specific areas.	

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TABLE 6 (Continued)

INITIAL SCREENING OF TECHNOLOGIES TYPES AND PROCESS OPTIONS FOR GROUNDWATER IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Removal Actions	Enhanced extraction	Steam injection: Steam is injected into the subsurface soils to enhance the removal of volatile and semi-volatile organics. Technology is applicable for subsurface soils present above or below the groundwater table. Extraction wells pump and treat groundwater and transport steam and vaporized contaminants under vacuum to the surface.	Retained	Potentially applicable. This technology is applicable to only volatile organic compounds and semi-volatile organic compounds. Not applicable to metals	4, 8
Removal Actions	Enhanced extraction	Vapor extraction: Volatile organics present in the subsurface soils are extracted by a series of injection/ extraction wells. The vapors are extracted by applying either vacuum or pressure or a combination of both. This technology is applicable only for subsurface soils above the water table.	Retained	Potentially applicable for volatile organic compounds.	7
Removal Actions	Enhanced extraction	Solvent injection: Injection of solvents into the groundwater to dissolve and mobilize the organic contaminants - To improve the effectiveness of Pump & Treat system.	Retained	Potentially applicable	8

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TABLE 6 (Continued)

INITIAL SCREENING OF TECHNOLOGIES TYPES AND PROCESS OPTIONS FOR GROUNDWATER IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Removal Actions	Enhanced extraction	Surfactant injection: Injection of surfactant into the groundwater to dissolve and mobilize inorganics and organics - To improve the effectiveness of Pump & Treat system.	Retained	Potentially applicable	8
Treatment Actions	Physical/ chemical treatment	Air stripping: A means of treating contaminated water by transferring the contaminants from the aqueous phase to the air phase	Retained	Potentially applicable: Applicable to organics with Henry's Law Constant > 3.0 x 10^{-03} atm-m^3/mole. Application of heat can increase the volatility of the constituents. Not applicable to metals or inorganics.	1, 2
Treatment Actions	Physical/ chemical treatment	Steam stripping: Is a unit process that uses steam to extract organics from aqueous streams. Can be considered as an alternative to air stripping, if the concentrations of the contaminants are too high or the volatility of the contaminants is too low for air stripping to be effective.	Retained	Potentially applicable to volatile organics. Similar to air stripping.	2

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TABLE 6 (Continued)

INITIAL SCREENING OF TECHNOLOGIES TYPES AND PROCESS OPTIONS FOR GROUNDWATER IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	Physical/ chemical treatment	Activated carbon adsorption: Is a surface phenomenon in which soluble molecules from a solution are bonded onto a particular substrate.	Retained	Potentially applicable: Removes organics and is also applicable to mercury removal	1, 2, 6
Treatment Actions	Physical/ chemical treatment	Dissolved air flotation: Separation of solids in a suspension by injecting pressurized air.	Retained	Potentially applicable as a pretreatment technology for solids removal	
Treatment Actions	Physical/ chemical treatment	Filtration: Removal of suspended solids from a fluid by passage of the fluid through a bed of granular material	Retained	Potentially applicable as a pretreatment technology for suspended solids removal.	2, 5
Treatment Actions	Physical/ chemical treatment	Precipitation/Flocculation/sedimentation: A combination of technologies used to remove inorganics from solution by precipitation, conglomeration, and gravity settling or sedimentation	Retained	Potentially applicable to inorganics (metals) removal; may also be used as pretreatment options for suspended solids removal.	1, 5
Treatment Actions	Physical/ chemical treatment	Membrane Technology: A general term for various membrane processes (Reverse Osmosis, Ultrafiltration, Hyperfiltration, and Electrodialysis) to separate dissolved and suspended material from water. Reverse Osmosis and Ultrafiltration have greater potential for use in site remediation processes than the other membrane processes	Retained	Potentially applicable for mercury and organics removal	1, 2, 5, 6

TABLE 6 (Continued)

INITIAL SCREENING OF TECHNOLOGIES TYPES AND PROCESS OPTIONS FOR GROUNDWATER IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	Physical/ chemical treatment	Ion exchange: Anions and cations in a dilute aqueous waste are removed from solution through the process of ion exchange	Retained	Potentially applicable for mercury removal	2, 5, 6
Treatment Actions	Physical/ chemical treatment	Distillation: A unit process that separates components of a liquid or sludge mixture by partially vaporizing the mixture and separately recovering the vapors and residue	Screened out	Process primarily applicable to the recovery of spent solvents Not applicable to low contaminant concentrations	2
Treatment Actions	Physical/ chemical treatment	Oxidation/reduction: Involves the chemical transformation of reactants in which the oxidation state of one reactant is raised while the other is lowered	Screened out	Presence of organics and inorganics complicates the treatment process Non-selective process More toxic by-products may be generated Uncertainty in the oxidation of the chemicals of concern at the site	1, 2, 5, 12
Treatment Actions	Physical/ chemical treatment	Neutralization: Neutralization is the interaction of an acid or a base with a solution to adjust the pH of the solution to the desired levels	Retained	Potentially applicable for pH control at the site.	1, 2, 5

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TABLE 6 (Continued)

INITIAL SCREENING OF TECHNOLOGIES TYPES AND PROCESS OPTIONS FOR GROUNDWATER IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	Biological treatment	Aerobic: Degradation of organics using microorganisms in an aerobic environment	Screened out	Not applicable to mercury removal; mercury may potentially be toxic to the microorganisms Chloroform, dichlorobenzene, and the higher chlorinated benzenes present at the site may be resistent to biodegradation Influent concentrations of the chemicals of concern at the site are too low (PPB levels)	6, 7, 9, 10, 11
Treatment Actions	Biological treatment	Anaerobic: Degradation of organics using microorganisms in an anaerobic environment	Screened out	Not applicable to mercury removal; mercury may potentially be toxic to the microorganisms Chloroform, dichlorobenzene, and the higher chlorinated benzenes present at the site may be resistent to biodegradation Influent concentrations of the chemicals of concern at the site are too low (PPB levels)	6, 7, 9, 10, 11

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TABLE 6 (Continued)

INITIAL SCREENING OF TECHNOLOGIES TYPES AND PROCESS OPTIONS FOR GROUNDWATER IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	In situ treatment	In situ Bioreclamation: System of injection and recovery wells introduce bacteria and nutrients to degrade contamination	Screened out	Not applicable to mercury removal; mercury may potentially be toxic to the microorganisms Chloroform, dichlorobenzene, and the other higher chlorinated benzenes present at the site may be resistent to biodegradation Concentrations of the chemicals of concern at the site are too low (PPB levels)	6, 7, 9, 10, 11
Disposal Actions	Discharge	Surface discharge: Discharge through existing NPDES outfall	Retained	Potentially applicable	
Disposal Actions	Discharge	Subsurface discharge: Injection into subsurface zones	Retained	Potentially applicable	

NOTES:

[1] References and other sources of information that were used to evaluate the technologies and process options are provided at the end of Table 8.

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INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
No action	None	Not applicable.	Retained	Required for consideration by NCP.	7
Institutional actions	Access restrictions	Fencing: Contaminated areas are surrounded by fences to control access.	Screened out	Access to the plant area is already restricted by fencing and a guarded main entrance.	7
Institutional actions	Access restrictions	Deed restrictions: Restrictions are placed on deeds concerning land usage.	Screened out	The deed for the McIntosh property already has a statement regarding the presence of hazardous waste on-site.	7
Institutional actions	Monitoring	Sampling: Periodic monitoring of groundwater in vicinity of SWMUs.	Retained	Increase in monitoring is potentially applicable; monitoring is already conducted as part of RCRA programs.	
Containment Actions	Capping	Clay cap: Compacted clay covered with soil over areas of contamination.	Retained	Known or suspected source areas have already been capped. Potentially applicable either for extending or replacing existing caps for OU-1 SWMUs/AOCs that were sampled during Phase III.	7
Containment Actions	Capping	Asphalt: Spray application of a layer of asphalt.	Retained	Known or suspected source areas have already been capped. Potentially applicable either for extending or replacing existing caps for OU-1 SWMUs/AOCs that were sampled during Phase III.	7

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TABLE 7 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Containment Actions	Capping	Concrete: Installation of concrete slabs over areas of contamination.	Retained	Known or suspected source areas have already been capped. Potentially applicable either for extending or replacing existing caps for OU-1 SWMUs/AOCs that were sampled during Phase III.	7
Containment Actions	Capping	Multimedia cap: Clay and synthetic membrane covered by soil over areas of contamination.	Retained	Known or suspected source areas have already been capped. Potentially applicable either for extending or replacing existing caps for OU-1 SWMUs/AOCs that were sampled during Phase III.	5
Containment Actions	Vertical barriers	Sheet piling: Sheet piles act as low-permeability subsurface barrier walls that either contain, capture, or redirect groundwater flow at the site. Sheet piles can be made of wood, pre-cast concrete, or steel. Steel piles are the most effective in terms of groundwater cut-off and cost.	Screened out	Not applicable as a soil remediation technology (above Alluvial Aquifer). Evaluated as a groundwater technology in Table 6 and Table 9.	5

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TABLE 7 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Containment Actions	Vertical barriers	Slurry walls: Slurry walls act as low-permeability subsurface barrier walls that either contain, capture, or redirect groundwater flow at the site. Soil-bentonite slurry walls are the most common slurry walls. Less common are the cement-bentonite and or concrete (diaphragm) walls.	Screened out	Not applicable as a soil remediation technology (above Alluvial Aquifer). Evaluated as a groundwater technology in Tables 6 and 9.	5
Containment Actions	Vertical barriers	Grouting: A process whereby one of a variety of fluids is injected into a rock or soil mass where it is set in place to reduce water flow and strengthen the formation. Grouting includes such technologies as rock grouting, and grout curtains.	Screened out	Has not yet been proven to be effective and reliable for hazardous waste sites. Other vertical barriers like slurry walls are preferred.	5
Containment Actions	Horizontal barriers	Grout injection: Drilling through the site and injecting a grout to form a horizontal or curved barrier to prevent the downward migration of contaminants.	Screened out	Developmental technology: detailed information on the application limitation, design, cost or construction considerations is not available.	5
Containment Actions	Horizontal barriers	Block displacement: Displacement and bottom sealing of a block of earth isolated by perimeter barriers, by continued grout or slurry pumping to prevent the downward migration of contaminants.	Screened out	Innovative technology: Information on the application of this technology to waste site remediation is not available.	5

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Removal Actions	Excavation	Conventional excavation equipment: Removal of sediments using conventional excavation equipment such as backhoes.	Retained	Potentially applicable.	
Treatment Actions	Encapsulation/ fixation	Stabilization/solidification: A technology by which the mobility of a chemical waste is reduced by either physically entrapping the waste and/or changing its chemical state. This technology can be categorized by the primary stabilizing agent used: cement-based, pozzolanic- or silicate based, thermoplastic-based, or organic polymer-based.	Retained	Potentially applicable: More applicable for metals than organics.	13, 15
Treatment Actions	Physical/ chemical treatment	Acid extraction: Heavy metals are extracted from the soil by the addition of acid.	Retained	Potentially applicable for mercury.	19
Treatment Actions	Physical/ chemical treatment	Basic Extraction Sludge Treatment (BEST®): Is a solvent extraction process that uses one or more secondary or tertiary amines (usually triethylamine [TEA]) to separate organics from soils and sludges.	Retained	Potentially applicable for organics.	1, 4

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TABLE 7 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	Physical/ chemical treatment	Liquified gas: Liquified gas is used as solvent to extract organics from sludges, contaminated soils, and wastewater. Carbon dioxide is used for wastewaters and propane is used for sludges and contaminated soil.	Retained	Potentially applicable for organics.	1, 4
Treatment Actions	Physical/ chemical treatment	Low-Energy Solvent Extraction Process (LEEP℠): Uses common organic solvents to extract and concentrate organic pollutants from soils, sediments, and sludges.	Retained	Potentially applicable for organics.	1, 4, 16
Treatment Actions	Physical/ chemical treatment	APEG-PLUS™: Similar to APEG™. Specifically uses potassium hydroxide and dimethyl sulfoxide to aid dehalogenation.	Retained	Potentially applicable for chlorinated organics.	17, 18
Treatment Actions	Physical/ chemical treatment	Oxidation/reduction: Process is applied to destroy hazardous waste components or convert the hazardous components to less hazardous forms by raising the oxidation state of one reactant and lowering that of the another.	Retained	Potentially applicable.	1, 2, 5, 12, 15, 17, 20, 21

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TABLE 7 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	Physical/ chemical treatment	Soil washing: Technology that uses water and mechanical action to remove hazardous constituents that adhere physically to soil particles. Soil washing separates the fine-grained particles from the coarser fraction. It makes use of the fact that contaminants have tendency to adhere to organic carbon and fine-grained soil fraction (silt and clay) as opposed to coarse-grained mixed fraction (sand and gravel).	Screened out	The high percentage of fines (predominantly clay) present in CPC landfill material make this technology less favorable.	15, 17, 19
Treatment Actions	Thermal	Fluidized bed: Waste is injected into a hot agitated bed of sand whereby combustion occurs.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	2, 15, 20
Treatment Actions	Thermal	Circulating bed combustor: Variation of fluidized bed incinerator - Uses higher air velocity and circulating solids to create a larger and highly turbulent combustion zone.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	2, 4, 15, 17, 20
Treatment Actions	Thermal	Rotary kiln: Involves the controlled combustion of organic wastes under net oxidizing conditions.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	2, 15, 17, 20

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INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	Thermal	Infrared : Uses silicon carbide elements to generate thermal radiation beyond the red end of the visible spectrum.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	4, 15, 17, 20, 22
Treatment Actions	Thermal	Pyrolysis: Destruction of organic material in the absence of oxygen at a higher temperature.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	15, 20
Treatment Actions	Thermal	Vitrification: A process by which organics are destroyed and inorganics are immobilized into a glassy material.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	15
Treatment Actions	Thermal	Advanced electric reactor: Uses electrically heated fluid walls to pyrolyze waste. Inorganic compounds melt and are fused into vitreous solids.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	2, 17, 20, 22, 24
Treatment Actions	Thermal	Thermal desorption: Uses heat in a controlled environment to cause various organic compounds to volatilize and thereby be removed from contaminated material.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process. Volatile mercury could potentially be removed from waste matrix.	4, 18, 19

TABLE 7 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	Biological	Aerobic: Degradation of organics using microorganisms in an aerobic environment.	Screened out	Variable waste composition present at the site causes inconsistent biodegradation by variation in biological activity. Not applicable for mercury. Mercury could potentially be toxic. Some of the predominant organics (e.g., higher chlorinated benzenes) present at the site are either recalcitrant or persistent to biodegradation.	6, 7, 9, 10, 11, 15
Treatment Actions	Biological	Anaerobic: Degradation of organics using microorganisms in an anaerobic environment.	Screened out	Variable waste composition present at the site causes inconsistent biodegradation by variation in biological activity. Not applicable for mercury. Mercury could potentially be toxic. Some of the predominant organics (e.g., higher chlorinated benzenes) present at the site are either recalcitrant or persistent to biodegradation.	6, 7, 9, 10, 11, 15

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TABLE 7 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	Biological	Slurry phase: Excavated soil, sludge, or sediment is mixed with water to form a slurry that is agitated with environment amenable to biodegradation. Slurry is dewatered and the solids are disposed upon completion of the process.	Screened out	Variable waste composition present at the site causes inconsistent biodegradation by variation in biological activity. Not applicable for mercury for mercury. Mercury could potentially be toxic. Some of the predominant organics (e.g., higher chlorinated benzenes) present at the site are either recalcitrant or persistent to biodegradation.	6, 7, 9, 10, 11, 15, 19
Treatment Actions	Biological	Solid phase: Excavated soils are placed on a lined treatment bed, tank, or building. Microbial growth is facilitated by adding nutrients and other additives into the soil. Air and water may also be supplied to the soil.	Screened out	Variable waste composition present at the site causes inconsistent biodegradation by variation in biological activity. Not applicable for mercury. Mercury could potentially be toxic. Some of the predominant organics (e.g., higher chlorinated benzenes) present at the site are either recalcitrant or persistent to biodegradation.	6, 7, 9, 10, 11, 15, 19

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TABLE 7 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	In situ	In situ bioreclamation: System of injection and recovery wells introduce bacteria and nutrients to degrade contamination.	Screened out	Variable waste composition present at the site causes inconsistent biodegradation by variation in biological activity. Not applicable for mercury. Mercury could potentially be toxic. Some of the predominant organics (e.g., higher chlorinated benzenes) present at the site are either recalcitrant or persistent to biodegradation. The solubility of some of the predominant contaminants is low. The permeability of the soil is low (clayey soil). pH at some of the locations is very acidic.	6, 9, 10, 11, 14, 15, 23
Treatment Actions	In situ	In situ soil flushing: An in situ process where the zone of contamination is flooded with water or a water-surfactant mixture in order to dissolve and mobilize the contaminants. Contaminants are then brought to the surface by a series of extraction wells.	Screened out	The permeability of the soil is low (clayey soil). Variable waste composition complicates this process. Some of the predominant organics have low solubility and high K_{ow} values.	14, 15, 23

TABLE 7 (continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	In situ	In situ vacuum and steam extraction: Volatile organics present at the site are extracted by a series of injection/extraction wells. The vapors are extracted by applying either vacuum or pressure or a combination of both. Steam is also injected to raise the soil temperature and thereby enhance the recovery of the organics.	Screened out	The air permeability of the soil is low (clayey soil). The vapor pressure of some of the predominant organics present at the site is low. Not applicable for mercury.	4, 14, 15, 23
Treatment Actions	In situ	In situ vitrification: Is an in situ process whereby the soil and waste is melted into a glassy, solid matrix resistant to leaching and more durable than granite or marble. Organics are destroyed and inorganics are immobilized.	Retained	Potentially applicable.	15
Treatment Actions	In situ	In situ stabilization/solidification: An in situ process in which stabilizing/solidifying agents are added to the soil to reduce the mobility of chemicals by either physically entrapping them or changing their chemical state.	Retained	Potentially applicable.	3, 4, 13, 15

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INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL IN OU-1

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References[1]
Treatment Actions	In situ	In situ chemical treatment: A process by which a wide range of treatment agents, including precipitating and neutralizing chemicals, oxidizing/reducing agents, dechlorinating and chelating agents are delivered directly to the waste source.	Retained	Potentially applicable.	14, 15
Disposal Actions	Off-site disposal	RCRA landfill: Disposal of wastes in a RCRA landfill.	Retained	Potentially applicable.	
Disposal Actions	On-site disposal	On-site RCRA landfill: Disposal of wastes in an on-site landfill.	Retained	Potentially applicable.	
Disposal Actions	On-site disposal	On-site placement: Treated materials are placed back on-site.	Retained	Potentially applicable.	
Disposal Actions	Off-site incinerator	Off-site RCRA incinerator. Disposal of material at commercial RCRA incinerator.	Retained	Potentially applicable. Presence of metals (including mercury) could influence application of this process.	

NOTES:

[1] References and other sources of information that were used to evaluate the technologies and process options are provided at the end of Table 8.

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TABLE 8

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
No action	None	Not applicable.	Retained	Required for consideration by NCP.	7
Institutional Actions	Access restrictions	Fencing: Contaminated areas are surrounded by fences to control access.	Retained	Potentially applicable.	7
Institutional Actions	Access restrictions	Fishing restrictions: To prevent human consumption of the fish in the ponded waters in OU-2.	Retained	Potentially applicable.	7
Institutional Actions	Monitoring	Sediment and fish monitoring: Periodic monitoring of the sediment and fish quality in OU-2	Retained	Potentially applicable.	
Containment Actions	Encapsulation/ fixation	Capping: For the ditches, would involve covering (e.g., with fresh soil, asphalt, concrete) the contaminated portions of the ditches to prevent the erosion, re-suspension, and transport of the suspended sediment, and reduce infiltration. For the basin, would involve the placement of imported sediment over existing sediments by pumping from a barge or dredge through a diffuser head over the sediment.	Retained	Potentially applicable.	17

TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Containment Actions	Encapsulation/ fixation	Backfilling: A form of containment that consists of covering the sediments to an above-grade elevation.	Retained	Potentially applicable.	17
Containment Actions	Encapsulation/ fixation	Sedimentation: Deposition of clean sediments over existing contaminated sediments to isolate the contaminated sediments from potential receptors; either from natural processes or mechanisms to enhance or expedite sedimentation.	Retained	Potentially applicable.	5, 17
Containment Actions	Encapsulation/ fixation	Stabilization/solidification: Cement, quicklime, or other grouting materials can be applied to the surface of, or mixed with, bottom sediments to create a seal which minimizes leaching and erosive transport of contaminated sediments.	Retained	Potentially applicable.	5
Removal Actions	Excavation	Conventional Excavation: Removal of sediments using conventional excavation equipment such as backhoes or draglines.	Retained	Potentially applicable.	
Removal Actions	Dredging	Mechanical: Mechanical dredges remove sediments by the direct application of mechanical force to dislodge sediment material. The dislodged sediment material is scooped away with a bucket.	Retained	Potentially applicable.	21

TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Removal Actions	Dredging	Hydraulic: Centrifugal pumps are used to remove sediments in a liquid slurry form.	Retained	Potentially applicable.	21
Removal Actions	Dredging	Pneumatic: Are similar to hydraulic dredges. Use compressed air and/or hydrostatic pressure instead of centrifugal force to remove sediments.	Retained	Potentially applicable.	13, 21
Treatment Actions	Encapsulation/ fixation	Stabilization/solidification: A technology by which the mobility of a chemical waste is reduced by either physically entrapping the waste and/or changing its chemical state. This technology can be categorized by the primary stabilizing agent used: cement-based, pozzolanic- or silicate based, thermoplastic-based, or organic polymer-based.	Retained	Potentially applicable: more applicable for metals than organics	15
Treatment Actions	Physical/ chemical treatment	Basic Extraction Sludge Treatment (BEST®): Is a solvent extraction process that uses one or more secondary or tertiary amines (usually triethylamine [TEA]) to separate organics from soils and sludges.	Retained	Potentially applicable for organics.	1, 4
Treatment Actions	Physical/ chemical treatment	Liquified gas: Liquified gas is used as solvent to extract organics from sludges, contaminated soils, and wastewater. Carbon dioxide is used for wastewaters and propane is used for sludges and contaminated soil.	Retained	Potentially applicable for organics.	1, 4

TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Treatment Actions	Physical/ chemical treatment	Low-Energy Solvent Extraction Process (LEEP™): Uses cor mon organic solvents to extract and concen rate organic constituents from soi'-, sediments, and sludges.	Retained	Potentially applicable for organics.	1, 4, 16
Treatment Actions	Physical treatment	Super critical extraction: Certain gases (e.g., carbon dioxide, propane, butane) are used as solvents for organic compounds when they are maintained at or near their critical pressure and temperature.	Retained	Potentially applicable for organics.	16
Treatment Actions	Physical/ chemical treatment	Acid extraction: Heavy metals are extracted from the sediment by the addition of acids.	Retained	Potentially applicable for mercury.	19
Treatment Actions	Physical/ chemical treatment	APEG™: Alkali metals hydroxides/ polyethylene glycols are used to dehalogenate certain classes of chlorinated organics.	Retained	Potentially applicable for chlorinated organics.	15, 17
Treatment Actions	Physical/ chemical treatment	APEG-PLUS™: Similar to APEG™. Specifically uses potassium hydroxide and dimethyl sulfoxide to aid dehalogenation.	Retained	Potentially applicable for chlorinated organics.	17, 18

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TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Treatment Actions	Physical/ chemical treatment	Catalytic dehydrochlorination: Is based on the reaction of polychl rinated hydrocarbons with hig pressure hydrogen gas in the presence of a catalyst. The feed must be in either a liquid or gaseous form with the inorganic and inert constituents removed.	Screened out	Applicable only for polychlorinated hydrocarbons. Feed must be either in a liquid or gaseous form.	20
Treatment Actions	Physical/ chemical treatment	Oxidation / reduction: Process is applied to destroy hazardous waste components or convert the hazardous components to less hazardous forms by raising the oxidation state of one reactant and lowering that of the another.	Retained	Potentially applicable for mercury and organics removal.	1, 2, 5, 12, 15, 17, 20, 21
Treatment Actions	Physical/ chemical treatment	Electrolytic oxidation: Cathodes and anodes are immersed in a tank containing a waste to be oxidized. Metals are plated out on the cathodes when an electric current is imposed.	Screened out	Primarily applicable to aqueous solution. This process is primarily applied for cyanide removal.	17, 20
Treatment Actions	Physical/ chemical treatment	Chemical hydrolysis: Process of breaking a bond in a molecule so that it will go into ionic solution by the addition of chemicals, by irradiation or biologically. The cloven molecule can then be further treated by other means to reduce toxicity.	Screened out	Not applicable for sediment matrix. Not applicable for the chemicals of concern in OU-2.	17, 20, 21

TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Treatment Actions	Physical/ chemical treatment	Chelation: A chelating molecule is used to form ligands with metal ions and make the metals unsuitable to form ionic salts which can precipitate. Chelation is used to keep metals in solution and to aid in dissolution for their subsequent transport and removal (e.g., soil washing).	Screened out	Not applicable -mercury is present in the sediment matrix not in solution.	17
Treatment Actions	Physical/ chemical treatment	Soil washing: Technology that uses water and mechanical action to remove hazardous constituents that adhere physically to soil particles. Soil washing separates the fine-grained particles from the coarser fraction. It makes use of the fact that contaminants have tendency to adhere to organic carbon and fine-grained soil fraction (silt and clay) as opposed to coarse-grained mixed fraction (sand and gravel).	Screened out	The high percentage of fines (predominantly clay) present in CPC landfill material make this technology less favorable.	15, 17, 19
Treatment Actions	Physical/ chemical treatment	Heavy media separation: Process for separating two solid materials which have significantly different absolute densities. Solids are placed in a fluid with a specific gravity so that the lighter solid floats while the heavier sinks.	Screened out	Not applicable for the matrix and chemicals of concern in OU-2.	17

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TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Treatment Actions	Thermal	Fluidized bed: Waste is injected into a hot agitated bed of sand whereby combustion occurs.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	2, 15, 20
Treatment Actions	Thermal	Circulating bed combustor: Variation of fluidized bed incinerator - Uses higher air velocity and circulating solids to create a larger and highly turbulent combustion zone.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	2, 4, 15, 17, 20
Treatment Actions	Thermal	Rotary kiln: Involves the controlled combustion of organic wastes under net oxidizing conditions.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	2, 15, 17, 20
Treatment Actions	Thermal	Wet air oxidation: Breaks down suspended and dissolved oxidizable inorganic and organic materials by oxidation in a high-temperature, high-pressure, aqueous environment.	Screened out	Primarily applied to the treatment of aqueous waste streams. Presence of metals (including mercury) could influence application of this process.	5, 15, 21, 22

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TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Treatment Actions	Thermal	Supercritical water oxidation: Involves thermal destruction of organics in waste water based on the ability of many organic compounds to dissolve in super critical water.	Screened out	Applicable to aqueous organic solution/ slurry or mixed organic/inorganic waste. Presence of metals (including mercury) could influence application of this process.	2, 5, 17, 22
Treatment Actions	Thermal	Molten glass: Uses a pool of molten glass as the heat transfer mechanism to destroy organics and to capture ash and inorganics.	Screened out	Primarily used to treat any solid or liquid such as plastics, asphalts, PCB or pesticides. Presence of metals (including mercury) could influence application of this process.	17, 20
Treatment Actions	Thermal	Infrared : Uses silicon carbide elements to generate thermal radiation beyond the red end of the visible spectrum.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	4, 15, 17, 20, 22
Treatment Actions	Thermal	Pyrolysis: Destruction of organic material in the absence of oxygen at a higher temperature.	Retained	Potentially applicable for organics. Presence of metals (including mercury) could influence application of this process.	15, 20

TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Treatment Actions	Thermal	Vitrification: A process by which organics are destroyed and inorganics are immobilized into a glassy material.	Retained	Potentially applicable. Presence of metals (including mercury) could influence application of this process.	15
Treatment Actions	Thermal	Advanced electric reactor: Uses electrically heated fluid walls to pyrolyze waste. Inorganics compounds melt and are fused into vitreous solids.	Retained	Primarily applied to soils. Presence of metals (including mercury) could influence application of this process.	2, 17, 20, 22, 24
Treatment Actions	Thermal	Plasma torch: Functions by contacting the waste feed with a gas which has been energized into its plasma state by an electrical discharge.	Screened out	Primarily applicable to liquid wastes. Presence of metals (including mercury) could influence application of this process.	22, 20
Treatment Actions	Thermal	Multiple hearth incinerator: Waste is fed through the furnace roof where a rotating air-cooled central shaft with air-cooled rabble arms and teeth plows the waste across the top hearth to dropholes where it falls too the next successive hearth until the ash is discharged at the bottom.	Screened out	Used for disposal of sludges, tars, solids, gases and liquid combustible wastes (through nozzles) Not recommended for hazardous wastes. Presence of metals (including mercury) could influence application of this process.	5, 17, 22

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TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Treatment Actions	Thermal	Thermal desorption: Uses heat in a controlled environment to cause various organic compounds to volatilize and thereby be removed from contaminated material.	Retained	Potentially applicable for the organics present at the site. Volatile mercury could also potentially be removed from the material. Presence of metals (including mercury) could influence application of this process.	4, 18, 19
Treatment Actions	Thermal	Slagging - offgas: This system operates under very high temperatures and converts the metal compounds into molten slag. Slagging may require air emission control systems.	Screened out	Applicable for metals with very high concentrations only. Presence of metals (including mercury) could influence application of this process.	19
Treatment Actions	Biological	Aerobic: Degradation of organics using microorganisms in an aerobic environment.	Screened out	Not applicable for mercury. Mercury could potentially be toxic. Hexachlorobenzene is a recalcitrant organic.	6, 7, 9, 10, 11, 15

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TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Treatment Actions	Biological	Anaerobic: Degradation of organics using microorganisms in an anaerobic environment.	Screened out	Not applicable for mercury. Mercury could potentially be toxic. Hexachlorobenzene is a recalcitrant organic.	6, 7, 9, 10, 11, 15
Treatment Actions	Biological	Slurry phase: Excavated soil, sludge, or sediment is mixed with water to form a slurry that is agitated with environment amenable to biodegradation. Slurry is dewatered and the solids are disposed upon completion of the process.	Screened out	Not applicable for mercury. Mercury could potentially be toxic. Hexachlorobenzene is a recalcitrant organic.	6, 9, 10, 11, 15, 19
Treatment Actions	Biological	Solid phase: Excavated soils are placed on a lined treatment bed, tank, or building. Microbial growth is facilitated by adding nutrients and other additives into the soil. Air and water may also be supplied to the soil.	Screened out	Not applicable for mercury. Mercury could potentially be toxic. Hexachlorobenzene is a recalcitrant organic.	6, 9, 10, 11, 15, 19
Treatment Actions	In situ	In situ bioreclamation: System of injection and recovery wells introduce bacteria and nutrients to degrade contamination.	Screened out	Not applicable for mercury. Mercury could potentially be toxic. Hexachlorobenzene is a recalcitrant organic.	6, 9, 10, 11, 14, 15, 23
Disposal Actions	Off-site disposal	RCRA landfill: Disposal of wastes in a RCRA landfill.	Retained	Potentially applicable.	

TABLE 8 (Continued)

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SEDIMENT IN OU-2

General Response Actions	Technology Type	Process Description	Status	Screening Comments	References
Disposal Actions	On-site disposal	On-site RCRA landfill: Disposal of wastes in an on-site landfill.	Retained	Potentially applicable.	
Disposal Actions	On-site disposal	On-site placement: Treated materials are placed back on-site.	Retained	Potentially applicable.	
Disposal Actions	Off-site Incinerator	Off-site RCRA incinerator: Disposal of material at commercial RCRA incinerator	Retained	Potentially applicable. Presence of metals (including mercury) could influence application of this process.	

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TABLE 8 (Continued)

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TABLE 9

EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
No action - Continuation of the existing RCRA CAP	Continuation of the existing RCRA cap.	**Continuation of the existing RCRA CAP**	The CAP is effective at controlling contaminant migration and moderately effective at contaminant reduction.	Not applicable.	Not applicable.
Institutional Action	Access restrictions	**Deed restrictions**	Effectiveness depends upon continued future implementation. Does not reduce contamination.	Legal requirements and authority.	Negligible cost.
Institutional Action	Monitoring	**Groundwater monitoring**	Effective for monitoring the groundwater conditions during and after remedial action.	Easily implementable.	Low capital, low O&M.
Containment Actions	Vertical barriers	Sheet piling	Interlocks of the steel piles are not water tight. The locks may never seal in a sandy soil and grouting may be necessary which would be costly. Only effective at containment - does not reduce contamination unless used with other technologies (e.g. extraction).	Implementable - Could be implemented in the localized areas of most concern; however difficult at the required depth (up to 100 ft).	Moderate to High capital, very low O&M.

* The shaded process options are retained.

TABLE 9 (Continued)

EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Containment Actions	Vertical barriers	Slurry walls	Effectiveness strongly contingent on proper implementation Only effective at containment - does not reduce contamination unless used with other technologies (e.g. extraction).	Implementable - Could be implemented in the localized areas of most concern; however difficult at the required depth (up to 100 ft). Careful monitoring required during implementation.	Moderate capital, very low O&M.
Removal Actions	Subsurface drains	Interceptor drains	Effective for soluble contaminants.	Primarily applicable to shallow depths. Very difficult to implement for Alluvial Aquifer.	Moderate capital, moderate O&M.
Removal Actions	Extraction	**Additional extraction wells**	Effective for soluble contaminants, well established as demonstrated by CAP.	Easily implementable.	Moderate capital, moderate O&M.
Removal Actions	Extraction	**Extractions with injection wells**	Effective for control of groundwater movement and soluble contaminant removal.	Easily implementable	Moderate capital, moderate O&M.

* The shaded process options are retained.

TABLE 9 (Continued)

EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Removal Actions	Extraction	**Horizontal wells**	Potentially effective innovative technology. Offers several advantages over vertical wells. Effectiveness of this technology for groundwater or vapor extraction requires further evaluation.	Potentially implementable for specific areas; would require further evaluation.	Cost depends upon the use of this technology in conjunction with the above - ground treatment system. Could potentially result in savings in operating and maintenance costs over the life of the remediation project.
Removal Actions	Enhanced extraction	**Steam injection**	Not effective for the removal of mercury. Potentially effective at reducing organic concentration above and below water table in Alluvial Aquifer.	Implementable; pilot-scale treatability testing required.	Moderate capital, moderate O&M.
Removal Actions	Enhanced extraction	Vapor extraction	Not effective for the removal of mercury. Not effective for semivolatile organics present at the site. Only effective above the water table.	Implementable.	Moderate capital, moderate O&M.

* The shaded process options are retained.

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TABLE 9 (Continued)

EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Removal Actions	Enhanced extraction	Solvent injection	Primarily applicable to organics. Innovative technology. Limited increased effectiveness over extraction wells alone.	Implementable, but injection and handling of solvents is a major disadvantage. Bench and pilot scale treatability studies would be required.	Moderate capital, moderate O&M.
Removal Actions	Enhanced extraction	Surfactant extraction	Applicable to inorganics and organics Innovative technology. Limited increased effectiveness over extraction wells alone	Implementable - Injection and handling of surfactants is a major disadvantage Bench and pilot scale treatability studies would be required.	Moderate capital, moderate O&M.
Treatment Actions	Physical/chemical treatment	Air stripping	Applicable to volatile organics.	Readily implementable. Existing CAP includes air stripping.	Moderate capital, moderate O&M.

* The shaded process options are retained.

TABLE 9 (Continued)

EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Treatment Actions	Physical/chemical treatment	**Steam stripping**	Applicable to volatile organics. Energy-intensive process. More applicable, when compared with air stripping, to contaminants with either higher concentrations or lower volatility.	Easily implementable.	Moderate to high capital and O&M.
Treatment Actions	Physical/chemical treatment	**Activated carbon adsorption**	Effective for mercury and organics removal.	Readily implementable Existing CAP includes carbon adsorption.	Moderate capital, moderate O&M.
Treatment Actions	Physical/chemical treatment	**Dissolved air[1] flotation**	Effective for removal of solids.	Easily implementable.	Moderate capital and O&M.
Treatment Actions	Physical/chemical treatment	**Filtration[1]**	Effective for removal of suspended solids.	Readily implementable.	Moderate capital and O&M.

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* The shaded process options are retained.

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TABLE 9 (Continued)

EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Treatment Actions	Physical/chemical treatment	**Precipitation/ flocculation/ sedimentation**	Effective for mercury removal and suspended solids.	Easily implementable. Bench-scale treatability testing required (e.g., to determine optimum combination of pH, precipitating and flocculating agents).	Moderate to high capital, moderate O&M.
Treatment Actions	Physical/chemical treatment	Membrane technology	Effective for mercury removal. May need extensive pretreatment of the groundwater. Other process options which are more favorable to the site conditions are retained.	Easily implementable Bench-scale treatability testing required.	High capital and O&M. Typically not used for general metals treatment.

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* The shaded process options are retained.

5 8 1367

TABLE 9 (Continued)

EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Treatment Actions	Physical/chemical treatment	Ion exchange	Effective for mercury removal. Needs disposal of regeneration solution. Other process options which are more favorable to the site conditions are retained.	Implementable for mercury. Bench-scale treatability testing required.	Moderate to high capital and O&M.
Treatment Actions	Physical/chemical treatment	**Neutralization[1]**	Effective for pH control.	Easily implementable.	Moderate capital and O&M.
Disposal Actions	Discharge	**Surface discharge through existing NPDES permit**	Effective and reliable.	Readily implemented - facility already maintains NPDES permit.	Low capital, very low O&M.

* The shaded process options are retained.

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3 8 1368

TABLE 9 (Continued)

EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Disposal Actions	Discharge	Injection into subsurface zones	Effective if implemented properly.	Would require extensive hydrogeologic evaluation to ensure protection of drinking water aquifers. Subject to agency permit.	Moderate capital and O&M.

NOTES:

1 Retained as potential pretreatment process option.

* The shaded process options are retained.

3 6 1367

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EVALUATION OF PROCESS OPTIONS FOR SOIL IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology Type	Process Options*	Effectiveness	Implementability	Cost
No action	None	**Not applicable**	No action taken.	Not applicable.	Not applicable
Institutional actions	Monitoring	**Sampling**	Aids in the post-closure monitoring of SWMUs. Does not reduce contamination.	Readily implementable.	Low capital and O&M.
Containment actions	Capping	**Clay cap**	Effective, susceptible to cracking, but has self-healing properties.	Easily implementable.	Low capital, low O&M.
Containment actions	Capping	Asphalt cap	Effective but susceptible to weathering and cracking; clay or multimedia cap more applicable for CPC landfill.	Easily implementable.	Low capital, high O&M.
Containment actions	Capping	Concrete cap	Effective but susceptible to weathering and cracking; clay or multimedia cap more applicable for CPC landfill.	Easily implementable.	High capital, low O&M.
Containment actions	Capping	**Multi-media cap**	Effective, proven, and reliable technology.	Easily implementable.	Moderate capital, low O&M.
Removal	Excavation	**Conventional excavation equipment**	Effective method for waste and soil excavation.	Readily implementable.	Moderate capital, low to moderate O&M.
Treatment	Encapsulation/ fixation	**Stabilization/ solidification**	Effective in reducing the mobility of the chemicals and in also reducing the exposure to the contaminants. Primarily applicable to metals, although organics can be stabilized/solidified.	Implementable. Bench scale testing would be required to determine the applicability of this technology to the organic wastes present at the site.	Moderate capital, low O&M.

* Shaded process options are retained.

TABLE 1. (Continued)

EVALUATION OF PROCESS OPTIONS FOR SOIL IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology Type	Process Options*	Effectiveness	Implementability	Cost
Treatment	Physical/ chemical	BEST[tm]	Potentially effective in extracting the organics present at the site. Does not destroy the contaminants. Further treatment and/or disposal is necessary. Not applicable for mercury removal.	Implementable. Bench and/or pilot scale testing would be required.	Moderate capital, moderate O&M.
Treatment	Physical/ chemical	Liquified gas[1]	Potentially effective in extracting the organics present at the site. Does not destroy the contaminants. Further treatment and/or disposal is necessary. Not applicable for mercury removal.	Implementable. Bench and/or pilot scale testing would be required.	Moderate capital, moderate O&M.
Treatment	Physical/ chemical	LEEP[tm]	Potentially effective in extracting the organics present at the site. Does not destroy the contaminants. Further treatment and/or disposal is necessary. Not applicable for mercury removal.	Implementable. Bench and/or pilot scale testing would be required.	Moderate capital, moderate O&M.
Treatment	Physical/ chemical	APEG-PLUS[tm]	Similar to APEG™. Potentially effective for dechlorinating the chlorinated organics present at the site. Not applicable for mercury removal. Further treatment (e.g., incineration, biological treatment, carbon adsorption) and/or disposal of the dechlorinated chemicals is necessary.	Implementable. Bench and/or pilot scale testing would be required.	Moderate capital, moderate O&M.

* Shaded process options are retained.

3 8 137.

TABLE [illegible] ontinued)

EVALUATION OF PROCESS OPTIONS FOR SOIL IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology Type	Process Options*	Effectiveness	Implementability	Cost
Treatment	Physical/ chemical	**Acid extraction**	Effective for mercury removal. Further treatment and disposal of mercury is necessary.	Implementable. Bench and/or pilot scale testing may be required.	Moderate capital, moderate O&M.
Treatment	Physical/ chemical	Oxidation/ reduction	Applicable to slurry with very low suspended solids content. Variable waste composition present at the site complicates this non-selective process. Presence of mixed wastes (mercury and organics) complicates this process. Chlorinated organics present at the site may form harmful byproducts. Chemical oxidation/reduction of the chlorinated organics at the site may be incomplete requiring further treatment.	Implementable. Bench or pilot scale treatability testing would be required.	Moderate capital, moderate O&M.
Treatment	Thermal	Fluidized bed	Destroys organics. Less effective than circulating bed combustor. Mercury, being a volatile metal, may impact process.	Implementable.	High capital and O&M.
Treatment	Thermal	**Circulating bed combustor**[2]	Effective and reliable. Destroys organics. Mercury, being a volatile metal, may impact process.	Implementable.	High capital and O&M.

* Shaded process options are retained.

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3 8 1372

TABLE 10 (Continued)

EVALUATION OF PROCESS OPTIONS FOR SOIL IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology Type	Process Options*	Effectiveness	Implementability	Cost
Treatment	Thermal	**Rotary kiln**[2]	Proven and reliable. Creates high particulates especially if the waste matrix has significant fines. Mercury, being a volatile metal, may impact process.	Implementable.	High capital and O&M.
Treatment	Thermal	**Infrared**[2]	Effective and reliable technology. Destroys organics. Mercury, being a volatile metal, may impact process.	Implementable.	High capital and O&M.
Treatment	Thermal	Pyrolysis	Organics are destroyed. May require auxiliary fuel for low BTU wastes. Applicable to solids, sludges, and viscous liquids. Innovative technology - other thermal technologies that are more applicable to soils and are widely available are preferred.	Implementable.	High capital and O&M.
Treatment	Thermal	Vitrification	Organics are destroyed. Offers advantages over other thermal technologies when dealing with mixed and complex wastes. Mercury, being a volatile metal, may impact process. Innovative technology - other thermal technologies that are more demonstrated and widely available are preferred.	Implementable.	Moderate to high capital and O&M.

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* Shaded process options are retained.

3 6 1373

EVALUATION OF PROCESS OPTIONS FOR SOIL IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology Type	Process Options*	Effectiveness	Implementability	Cost
Treatment	Thermal	Advanced electric reactor	Effective for organics removal. Post-treatment for incomplete combustion may be required. Mercury, being a volatile metal, may impact process. Innovative technology - other incineration technologies which are more reliable and proven are preferred.	Implementable.	High capital and O&M.
Treatment	Thermal	**Thermal desorption**	Effective for the desorption of volatile and semivolatile organics. Volatile mercury could be desorbed. Further treatment and/or disposal is needed.	Implementable. Moisture content has to be low. Solids processing will be required as a pre-treatment step.	Moderate capital, moderate O&M.
Treatment	In situ	In situ vitrification	Effective for the destruction of the organics present at the site. Technology is best used for mixed, complex, and radioactive wastes. The concentrations of the organics present at the site are too low for this technology to be effectively implemented. Mercury, being a volatile metal, may impact process.	Implementable. This technology at the present time is being marketed by few vendors. Needs specialized equipment and trained operators. Not yet widely implemented for CERCLA sites.	High capital and O&M.

* Shaded process options are retained.

3 8 137

EVALUATION OF PROCESS OPTIONS FOR SOIL IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology Type	Process Options*	Effectiveness	Implementability	Cost
Treatment	In situ	**In situ stabilization/ solidification**	Effective in reducing the mobility of the chemicals. The in-situ process is more comp'icated and is more difficult to implement than the ex-situ process.	Bench scale treatability studies would be required to determine the effectiveness of this technology for the site. May also require pilot scale testing evaluate applicability to in situ conditions.	Moderate capital, low O&M.
Treatment	In situ	In situ chemical treatment	The presence of various organics chemicals and mercury at the site along with naturally occurring organic and inorganic substances complicates the use of this process. The products of treatment may be more mobile and/or toxic than the parent chemicals. Limited information is currently available on the effectiveness and applicability of this process. Effectiveness of this technology is contingent upon treatability studies.	Bench and pilot scale treatability studies would be required. This process has not been widely demonstrated and in most cases is in bench and/or pilot-scale testing.	Moderate capital and low O&M.
Disposal	Off-site	**Off-site RCRA landfill**	Effective for containment of waste. No reduction of chemical toxicity or volume. Contaminants are removed from the site.	Implementable. Waste has to be transported to the landfill. Land disposal restrictions may apply.	High capital, none to low O&M.

* Shaded process options are retained.

3 8 137

EVALUATION OF PROCESS OPTIONS FOR SOIL IN OU-1 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology Type	Process Options*	Effectiveness	Implementability	Cost
Disposal	On-site	**On-site RCRA landfill**	Effective for containment of waste. No reduction of chemical toxicity or volume.	Difficult to implement - minimum technical requirements (MTR) and land dispoal restrictions may apply. Agency and state/public acceptance could interfere.	Very high capital, moderate O&M.
Disposal	On-site	**On-site placement of treated material**	Effective. Environmental impact is reduced at the site because of the treated materials.	Implementable. MTR and land disposal restrictions may apply.	Moderate capital and O&M.
Disposal	Off-site Incinerator	**Off-site RCRA incinerator**	Effective in the destruction of organics.	Implementable.	Very high capital

NOTES:

[1] Chemical extraction and dechlorination are retained. Further evaluation is required to select the most applicable process option.
[2] Thermal treatment is retained. Further evaluation is required to select the most applicable process option.

* Shaded process options are retained.

3 8 1376

TABLE 11

EVALUATION OF PROCESS OPTIONS FOR SEDIMENT IN OU-2 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
No action	None	**Not applicable**	No action taken.	Not applicable.	Not applicable.
Institutional actions	Access restrictions	**Fencing**	Provides access restrictions thereby reducing exposure to the chemicals. Does not reduce contamination.	Easily implementable.	Low capital and O&M costs.
Institutional actions	Access restrictions	**Fishing restrictions**	Regulates human consumption of any contaminated fish. Does not reduce contamination.	Easily implementable. Some fishing restrictions already exist. Would require increased enforcement.	Low capital and O&M costs.
Institutional actions	Monitoring	**Sediment and fish monitoring**	Effective in monitoring the quality of fish and sediment. Does not reduce contamination. Does not eliminate exposure of fish to the contaminants.	Easily implementable.	Low capital and O&M costs.
Containment actions	Encapsulation/ fixation	**Capping**[1]	Not applicable for basin. Potentially effective for ditches in reducing exposure to the contaminated sediments and in containing sediment transport. May be effective to some extent in restricting the downward migration of the contaminants. Contaminant concentration is not reduced.	Could not be implemented in basin without disruption of the OU-2 basin-eco-system. Moderately difficult to implement in wastewater ditch due to extent of ditch and the necessity to reroute the flow.	Moderate capital, low O&M.

* The shaded process options are retained.

3 8 1377

TABLE 11 (Continued)

EVALUATION OF PROCESS OPTIONS FOR SEDIMENT IN OU-2 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Containment actions	Encapsulation/ fixation	Backfilling	Effective in reducing exposure to the contaminated sediments and in containing sediment transport. May be effective to some extent in restricting the downward migration of the contaminants. Contaminant concentration is not reduced. Basin eco-system will be destroyed and the site hydrology altered. Land use is altered	Difficult to implement due to the very high volume of backfill required.	Moderate capital, low O&M.
Containment actions	Encapsulation/ fixation	Sedimentation	Effective in reducing exposure to the contaminated sediments and in containing sediment transport. May be effective to some extent in restricting the downward migration of the contaminants. Contaminant concentration is not reduced. Is a slower process than other encapsulation processes.	Difficult to implement due to dynamic nature of basin hydraulics. Hydrologic and sedimentation studies would have to be conducted. Pilot scale testing may be required for enhanced or expedited sedimentation processes.	Moderate capital and low O&M.
Containment actions	Encapsulation/ fixation	**Stabilization/[1] solidification**	Effective in reducing exposure to the contamination. Effective in reducing the mobility of the contaminants. Will destroy the biotic zone of the basin. Is more applicable to the ditch sediments.	Implementable for ditch sediments. Bench scale testing would be required.	Moderate to high capital, low O&M.

* The shaded process options are retained.

TABLE 11 (Continued)

EVALUATION OF PROCESS OPTIONS FOR SEDIMENT IN OU-2
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Removal	Excavation	**Conventional Excavation**[1]	Effective method for removing dry ditch sediments and soils. Not applicable to basin sediments.	Easily implementable for ditch sediments.	Moderate capital, low to moderate O&M.
Removal	Dredging	**Mechanical**	Effective for sediment dredging. Large amounts of sediments may be resuspended. Dredged material must be rehandled.	Implementable.	Moderate to High.
Removal	Dredging	**Hydraulic**	Effective for sediment dredging. Resuspension of sediments is limited. Production capacity generally higher than mechanical dredging. Rehandling of dredged material could be eliminated. Large volumes of water removed with the sediment must be treated. Most debris cannot be removed.	Some of the hydraulic dredges are only transportable on navigable waters. Some dredges have vessel length/draft limitation.	Moderate.
Removal	Dredging	Pneumatic	Effectiveness similar to that of the hydraulic dredges. Pneumatic dredges produce slurries of higher solids content and cause less resuspension of sediments.	Not widely available. Pneumatic dredges require a minimum of 7 1/2 feet of water. This depth limitation will be a limiting factor for its application at the OU-2 basin.	Moderate.

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* The shaded process options are retained.

TABLE 11 (Continued)

EVALUATION OF PROCESS OPTIONS FOR SEDIMENT IN OU-2
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Treatment	Encapsulation/ fixation	**Stabilization/ solidification**	Effective in reducing the mobility of the chemicals and in also reducing the exposure to the contaminants. Primarily applicable to metals although some organics can also be stabilized/solidified.	Bench and/or pilot scale testing would be required.	Moderate to high capital, low O&M.
Treatment	Physical/ chemical	**BEST**[2]	Potentially effective in extracting hexachlorobenzene and other organics at the site. Not effective for mercury removal. Does not destroy the contaminants. Further treatment and/or disposal is necessary.	Implementable. Bench and/or pilot scale testing would be required.	Moderate capital, moderate O&M.
Treatment	Physical/ chemical	**Liquified gas**[2]	Potentially effective in extracting hexachlorobenzene and other organics at the site. Not effective for mercury removal. Does not destroy the contaminants. Further treatment and/or disposal is necessary.	Implementable. Bench and/or pilot scale testing would be required.	Moderate capital, moderate O&M.
Treatment	Physical/ chemical	**LEEP**[2]	Potentially effective in extracting hexachlorobenzene and other organics at the site. Not effective for mercury removal. Does not destroy the contaminants. Further treatment and/or disposal is necessary.	Implementable. Bench and/or pilot scale testing would be required.	Moderate capital, moderate O&M.

* The shaded process options are retained.

TABLE 11 (Continued)

EVALUATION OF PROCESS OPTIONS FOR SEDIMENT IN OU-2
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Treatment	Physical/ chemical	Supercritical extraction	Similar to liquified gas extraction but operates at different pressures and temperatures. Potentially effective for extracting hexachlorobenzene and other organics at the site. Not effective for mercury removal. Does not destroy the contaminants. Further treatment and/or disposal is necessary. Liquified gas has been experienced to be more practical than this technology.	Implementable. Bench and/or pilot scale testing would be required.	Moderate capital, moderate O&M.
Treatment	Physical/ chemical	Acid extraction	Effective for mercury removal. Further treatment and disposal of mercury is necessary.	Implementable. Bench and/or pilot scale testing may be required.	Moderate capital, moderate O&M.
Treatment	Physical/ chemical	APEG	Effective for dechlorinating chlorinated organics. Not applicable for mercury removal. Further treatment (e.g., incineration, biological treatment, carbon adsorption) and/or disposal of the dechlorinated chemicals is necessary.	Implementable. Bench and/or pilot scale testing would be required.	Moderate capital, moderate O&M.

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* The shaded process options are retained.

3 6 1331

TABLE 11 (Continued)

EVALUATION OF PROCESS OPTIONS FOR SEDIMENT IN OU-2 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Treatment	Physical/ chemical	APEG - Plus[2]	Similar to APEG. Effective for dechlorinating the hexachlorobenzene Not applicable for mercury removal. Further treatment (e.g., incineration, biological treatment, carbon adsorption) and/or disposal of the dechlorinated chemicals is necessary. This process is potentially more applicable than APEG.	Implementable. Bench and/or pilot scale testing would be required.	Moderate capital, moderate O&M.
Treatment	Physical/ chemical	Oxidation/ reduction	Applicable to slurry with very low suspended solids content. Presence of mixed wastes (metals and organics) complicates this process. Chlorinated organics present at the site may form harmful byproducts. Chemical oxidation of the chlorinated organics at the site may be incomplete requiring further treatment. The high organic content present at the site complicates the redox reactions, requiring large amounts of reagents.	Implementable. Treatability testing would be required.	Moderate capital, moderate O&M.

* The shaded process options are retained.

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3 8 1383

TABLE 11 (Continued)

EVALUATION OF PROCESS OPTIONS FOR SEDIMENT IN OU-2 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Treatment	Thermal	Fluidized bed	Destroys organics. Not applicable to mercury removal. Mercury being a volatile, may impact the process. Less effective than circulating bed combustor.	Implementable.	High capital and O&M costs.
Treatment	Thermal	**Circulating bed combustor**[3]	Recently demonstrated effective and reliable. Destroys organics. Not applicable for mercury removal. Mercury being a volatile, may impact the process. Is more efficient than fluidized bed	Implementable. Availability is questionable.	High capital and O&M costs.
Treatment	Thermal	**Rotary kiln**[3]	Proven and reliable. Mercury may impact the process. Creates high particulates.	Implementable. Mobile units available.	High capital and O&M costs.
Treatment	Thermal	**Infrared**[3]	Effective and reliable technology. Destroys organics. Mercury may impact the process. Applicable to silt/clay particle sizes and high moisture content (up to 50 percent by weight).	Implementable. Mobile units available.	High capital and O&M costs.
Treatment	Thermal	Pyrolysis	Organics are destroyed. May require auxiliary fuel for low BTU wastes. Mercury may impact the process. Applicable to solids, sludges, and viscous liquids. Other thermal processes, which are more conducive to sediments, (fine silty clay) are preferred.	Other available mobile technologies that can process high volumes per day are preferred.	High capital and O&M costs.

* The shaded process options are retained.

TABLE 11 (Continued)

EVALUATION OF PROCESS OPTIONS FOR SEDIMENT IN OU-2 BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Treatment	Thermal	Vitrification	Organics are destroyed. Mercury may impact this process. Other thermal technologies that are more demonstrated are more applicable.	Implementable. Moisture content has to be very low.	High to moderate capital and O&M costs.
Treatment	Thermal	Advanced electric reactor	Effective for organics removal. Post-treatment for incomplete combustion may be required. Mercury may impact the process. Innovative technology.	Other incineration technologies are considered more reliable and are proven more applicable	High capital and O&M costs.
Treatment	Thermal	**Thermal desorption**	Effective for the desorption of volatile and semi-volatiles. Elemental mercury may also be desorbed. Further treatment and/or disposal is needed.	Implementable. Moisture content has to be low.	Moderate capital, moderate O&M.
Disposal	Off-site	**Off-site RCRA landfill**	Sediments in OU-2 have to be dewatered tughly. Effective for containment of waste. No reduction of chemical toxicity or volume. Contaminants are removed from the site.	Implementable. Waste has to be transported to the landfill. Land ban restrictions may apply.	High capital, none to low O&M.
Disposal	On-site	**On-site RCRA landfill**	Sediments in OU-2 have to be dewatered thoroughly. Effective for containment of waste. No reduction of chemical toxicity or volume.	Difficult to implement - minimum technical requirements (MTR) and land disposal restrictions may apply. Agency and state/public acceptance could interfere.	Moderate to High capital, moderate O&M.

* The shaded process options are retained.

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TABLE 11 (Continued)

EVALUATION OF PROCESS OPTIONS FOR SEDIMENT IN OU-2
BASED ON EFFECTIVENESS, IMPLEMENTABILITY, AND COST

GRA	Technology type	Process options*	Effectiveness	Implementability	Cost
Disposal	On-site	**On-site placement of treated material**	Effective. Environmental impact is reduced at the site because of the treated materials	Implementable. MTR and land ban restrictions may apply.	Moderate capital and O&M costs.
Disposal	Off-site Incinerator	**Off-site RCRA incinerator**	Effective in the destruction of organics. May require pretreatment or residuals treatment for mercury.	Implementable.	Very High capital.

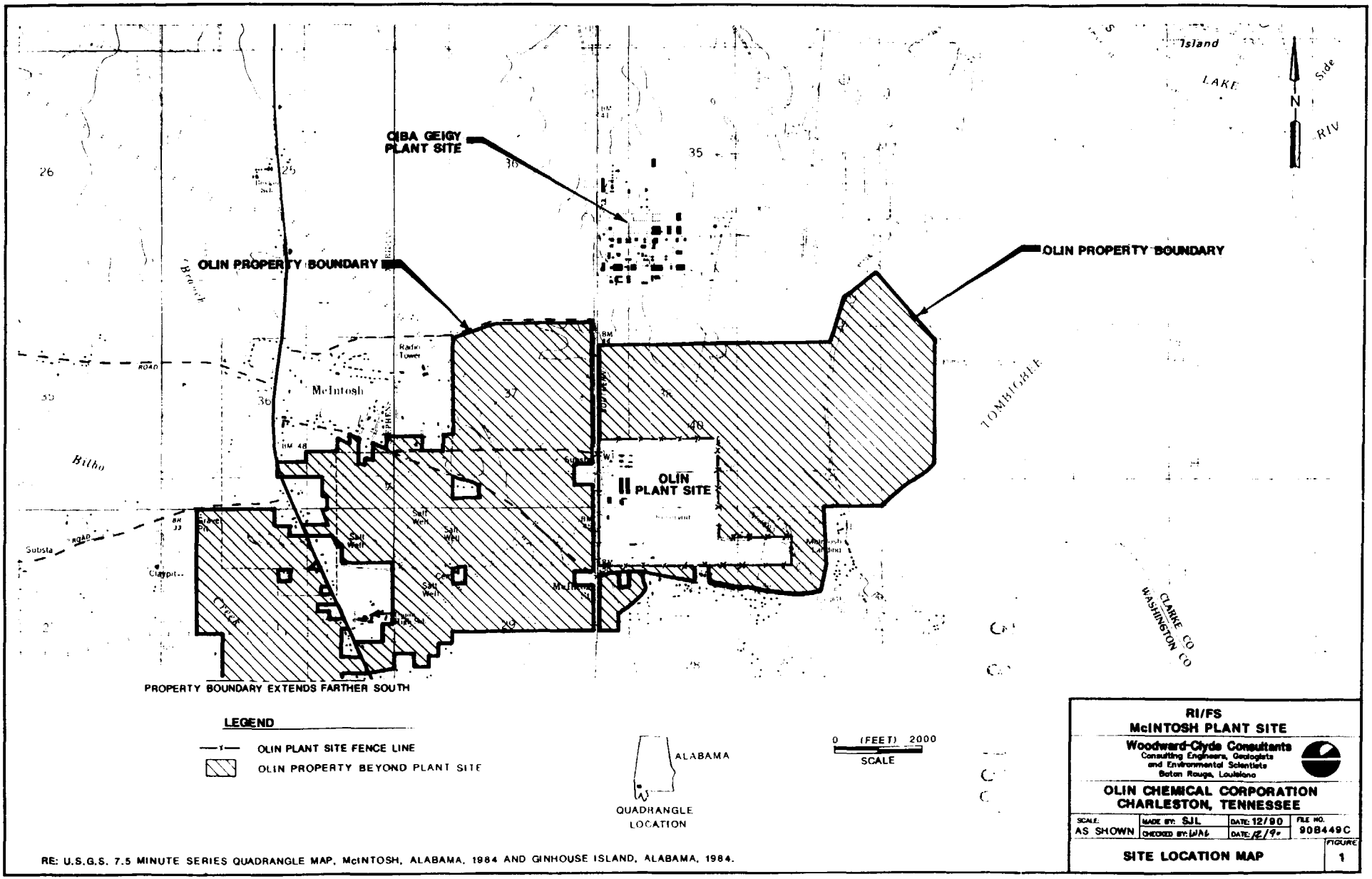
NOTES:

1 Retained for ditches only.
2 Chemical extraction and dechlorination are retained as a sediment treatment technology for organics. Further evaluation is required to select the most applicable process option.
3 Thermal treatment is retained. Further evaluation is required to select the most applicable process option.

* The shaded process options are retained.

3 8 133

FIGURES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OLIN
PLANT SITE
McIntosh
Island
LAKE
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RIV
TOMBIGBEE
CLARKE CO
WASHINGTON CO
PROPERTY BOUNDARY EXTENDS FARTHER SOUTH
LEGEND
OLIN PLANT SITE FENCE LINE
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ALABAMA
QUADRANGLE
LOCATION
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RI/FS
McINTOSH PLANT SITE
Woodward-Clyde Consultants
Consulting Engineers, Geologists
and Environmental Scientists
Baton Rouge, Louisiana
OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE
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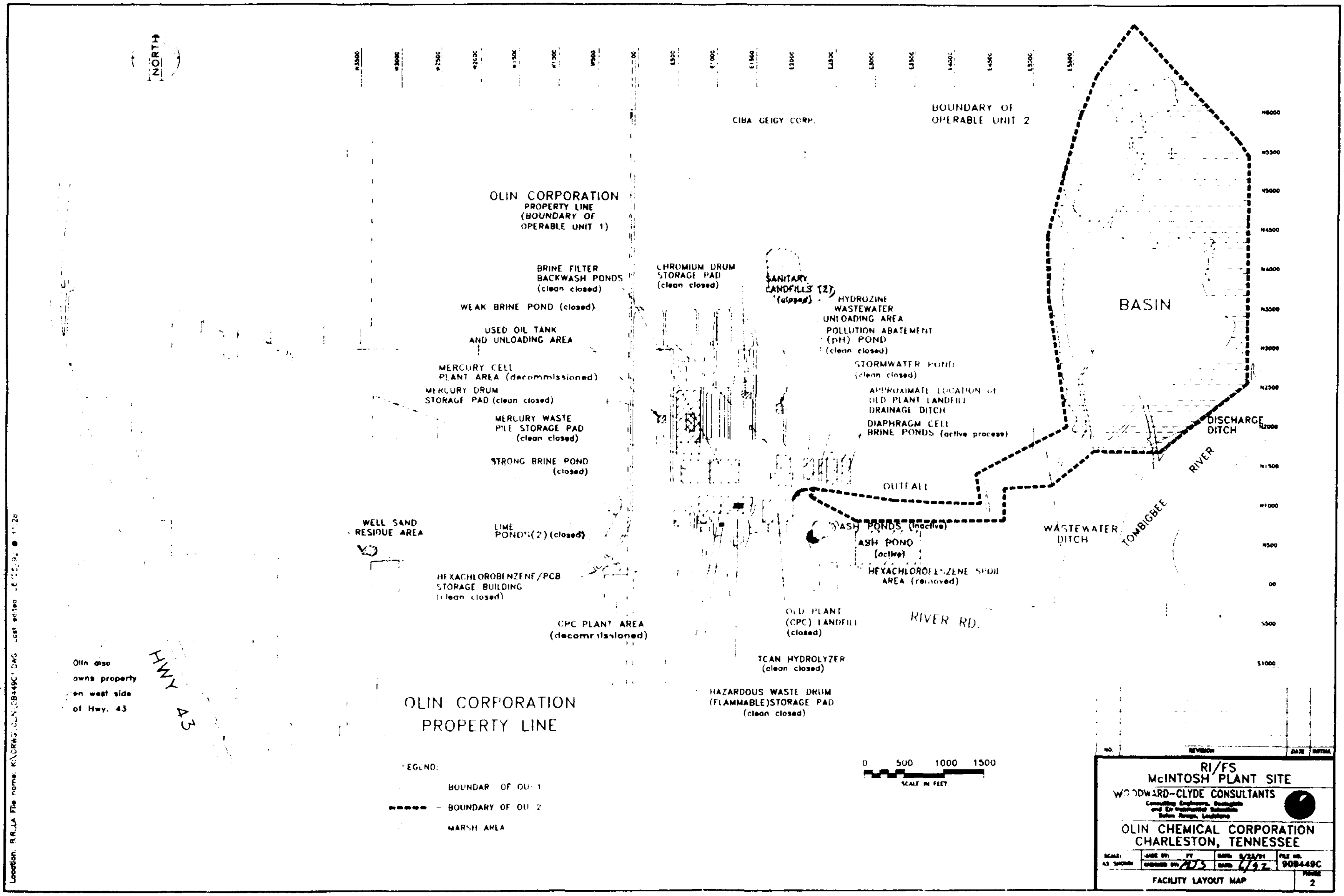
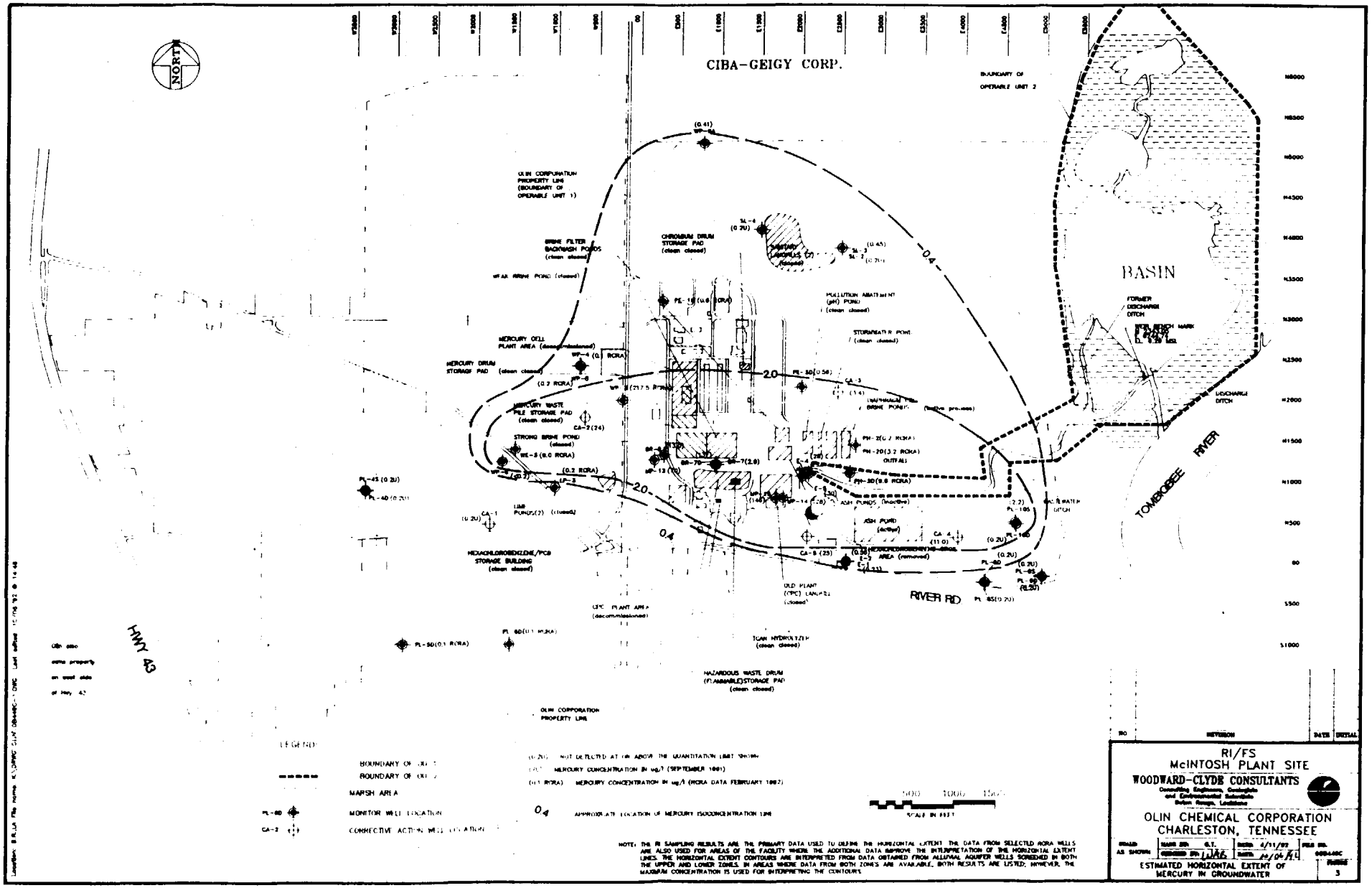
SITE LOCATION MAP


NORTH
BOUNDARY OF
OPERABLE UNIT 2
CIBA GEIGY CORP.
OLIN CORPORATION
PROPERTY LINE
(BOUNDARY OF
OPERABLE UNIT 1)
BRINE FILTER
BACKWASH PONDS
(clean closed)
CHROMIUM DRUM
STORAGE PAD
(clean closed)
SANITARY
LANDFILLS (2)
(closed)
HYDROZINE
WASTEWATER
UNLOADING AREA
WEAK BRINE POND (closed)
USED OIL TANK
AND UNLOADING AREA
POLLUTION ABATEMENT
(pH) POND
(clean closed)
STORMWATER POND
(clean closed)
MERCURY CELL
PLANT AREA (decommissioned)
MERCURY DRUM
STORAGE PAD (clean closed)
APPROXIMATE LOCATION of
OLD PLANT LANDFILL
DRAINAGE DITCH
MERCURY WASTE
PILE STORAGE PAD
(clean closed)
DIAPHRAGM CELL
BRINE PONDS (active process)
BASIN
DISCHARGE
DITCH
RIVER
STRONG BRINE POND
(closed)
OUTFALL
WELL SAND
RESIDUE AREA
LIME
PONDS(2) (closed)
ASH PONDS (inactive)
ASH POND
(active)
WASTEWATER
DITCH
TOMBIGBEE
HEXACHLOROBENZENE/PCB
STORAGE BUILDING
(clean closed)
HEXACHLOROBENZENE SPOIL
AREA (removed)
CPC PLANT AREA
(decommissioned)
OLD PLANT
(CPC) LANDFILL
(closed)
RIVER RD.
TCAN HYDROLYZER
(clean closed)
HAZARDOUS WASTE DRUM
(FLAMMABLE)STORAGE PAD
(clean closed)
Olin also
owns property
on west side
of Hwy. 43
HWY 43
OLIN CORPORATION
PROPERTY LINE
LEGEND:
BOUNDARY OF OU-1
BOUNDARY OF OU-2
MARSH AREA
0 500 1000 1500
SCALE IN FEET
RI/FS
McINTOSH PLANT SITE
WOODWARD-CLYDE CONSULTANTS
OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE
90B449C
FACILITY LAYOUT MAP
2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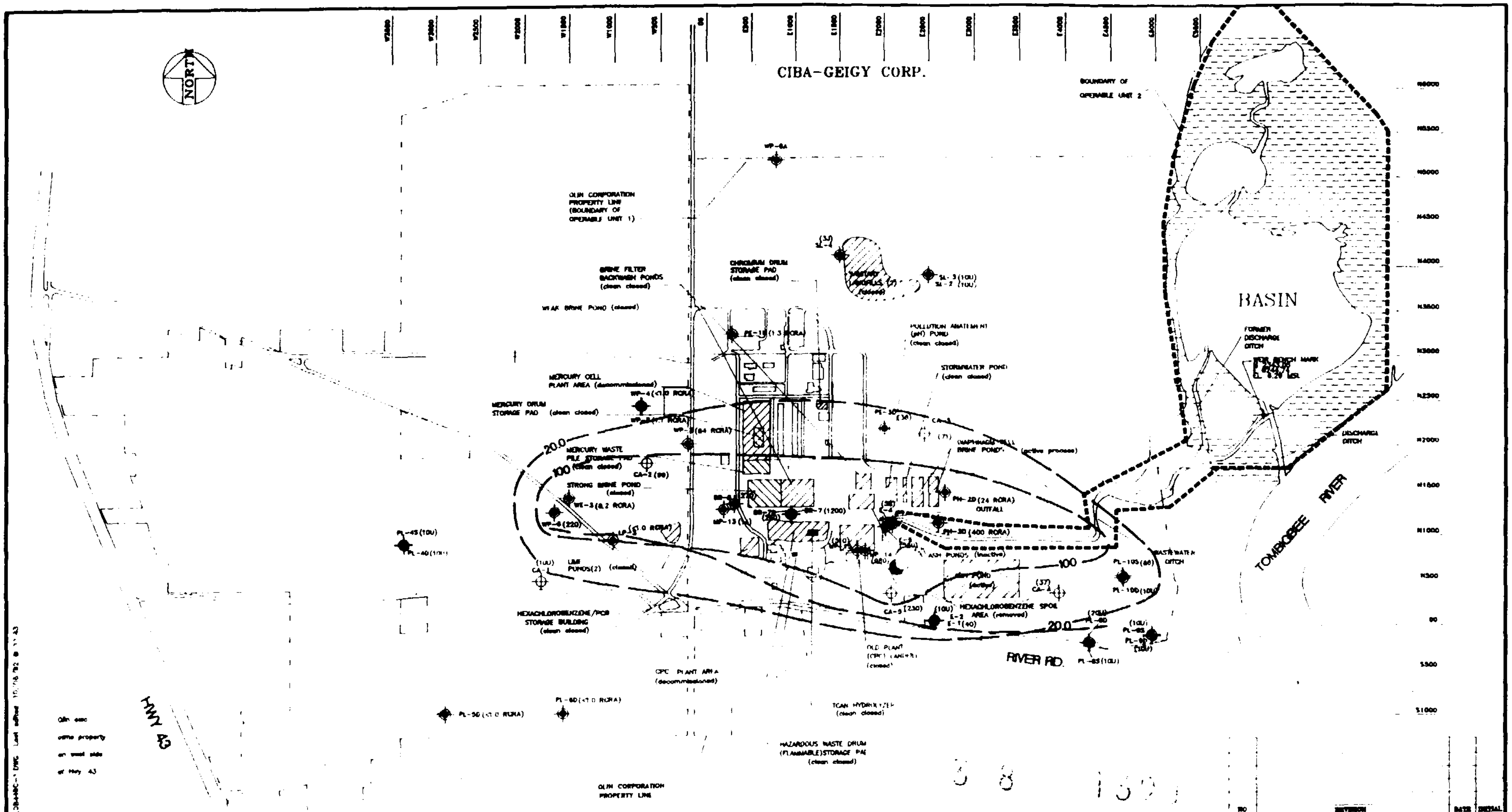
BASIN
TOMBIGBEE RIVER
RIVER RD
HWY 43
OLIN CORPORATION PROPERTY LINE (BOUNDARY OF OPERABLE UNIT 1)
BOUNDARY OF OPERABLE UNIT 2
BRINE FILTER BACKWASH PONDS (clean closed)
CHROMIUM DRUM STORAGE PAD (clean closed)
MERCURY CELL PLANT AREA (decommissioned)
MERCURY DRUM STORAGE PAD (clean closed)
MERCURY WASTE PILE STORAGE PAD (clean closed)
STRONG BRINE POND (closed)
LIME PONDS (2) (closed)
HEXACHLOROBENZENE/PCB STORAGE BUILDING (clean closed)
POLLUTION ABATEMENT (pH) POND (clean closed)
STORMWATER POND (clean closed)
ASH PONDS (inactive)
ASH POND (active)
OLD PLANT (CPC) LANDFILL (closed)
CPC PLANT AREA (decommissioned)
TCAN HYDROLYZER (clean closed)
HAZARDOUS WASTE DRUM (FLAMMABLE) STORAGE PAD (clean closed)
FORMER DISCHARGE DITCH
DISCHARGE DITCH
BENCH MARK
LEGEND
BOUNDARY OF OU 1
BOUNDARY OF OU 2
MARSH AREA
MONITOR WELL LOCATION
CORRECTIVE ACTION WELL LOCATION
(0.2U) NOT DETECTED AT OR ABOVE THE QUANTITATION LIMIT SHOWN
(0.2) MERCURY CONCENTRATION IN ug/l (SEPTEMBER 1991)
(0.1 RCRA) MERCURY CONCENTRATION IN ug/l (RCRA DATA FEBRUARY 1992)
0.4 APPROXIMATE LOCATION OF MERCURY ISOCONCENTRATION LINE
SCALE IN FEET
NOTE: THE RI SAMPLING RESULTS ARE THE PRIMARY DATA USED TO DEFINE THE HORIZONTAL EXTENT. THE DATA FROM SELECTED RCRA WELLS ARE ALSO USED FOR AREAS OF THE FACILITY WHERE THE ADDITIONAL DATA IMPROVE THE INTERPRETATION OF THE HORIZONTAL EXTENT LINES. THE HORIZONTAL EXTENT CONTOURS ARE INTERPRETED FROM DATA OBTAINED FROM ALLUVIAL AQUIFER WELLS SCREENED IN BOTH THE UPPER AND LOWER ZONES. IN AREAS WHERE DATA FROM BOTH ZONES ARE AVAILABLE, BOTH RESULTS ARE LISTED; HOWEVER, THE MAXIMUM CONCENTRATION IS USED FOR INTERPRETING THE CONTOURS.
RI/FS
McINTOSH PLANT SITE
WOODWARD-CLYDE CONSULTANTS
OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE
ESTIMATED HORIZONTAL EXTENT OF MERCURY IN GROUNDWATER
FIGURE 3



LEGEND

BOUNDARY OF OU 1

BOUNDARY OF OU 2

MARSH AREA

PL-80 MONITOR WELL LOCATION

CA-2 CORRECTIVE ACTION WELL LOCATION

10U - NOT DETECTED AT OR ABOVE THE QUANTITATION LIMIT SHOWN

3J - ESTIMATED CONCENTRATION BELOW THE QUANTITATION LIMIT

(70) - CHLOROFORM CONCENTRATION IN ug/l (SEPTEMBER 1991)

(0.1 RCRA) - CHLOROFORM CONCENTRATION IN ug/l (RCRA DATA FEBRUARY 1992)

20.0 APPROXIMATE LOCATION OF CHLOROFORM ISOCONCENTRATION LINE

500 1000 1500

SCALE IN FEET

NOTE: THE RI SAMPLING RESULTS ARE THE PRIMARY DATA USED TO DEFINE THE HORIZONTAL EXTENT. THE DATA FROM SELECTED RCRA WELLS ARE ALSO USED FOR AREAS OF THE FACILITY WHERE THE ADDITIONAL DATA IMPROVE THE INTERPRETATION OF THE HORIZONTAL EXTENT LINES. THE HORIZONTAL EXTENT CONTOURS ARE INTERPRETED FROM DATA OBTAINED FROM ALLUVIAL AQUIFER WELLS SCREENED IN BOTH THE UPPER AND LOWER ZONES. IN AREAS WHERE DATA FROM BOTH ZONES ARE AVAILABLE, BOTH RESULTS ARE LISTED; HOWEVER, THE MAXIMUM CONCENTRATION IS USED FOR INTERPRETING THE CONTOURS.

RI/FS
McINTOSH PLANT SITE

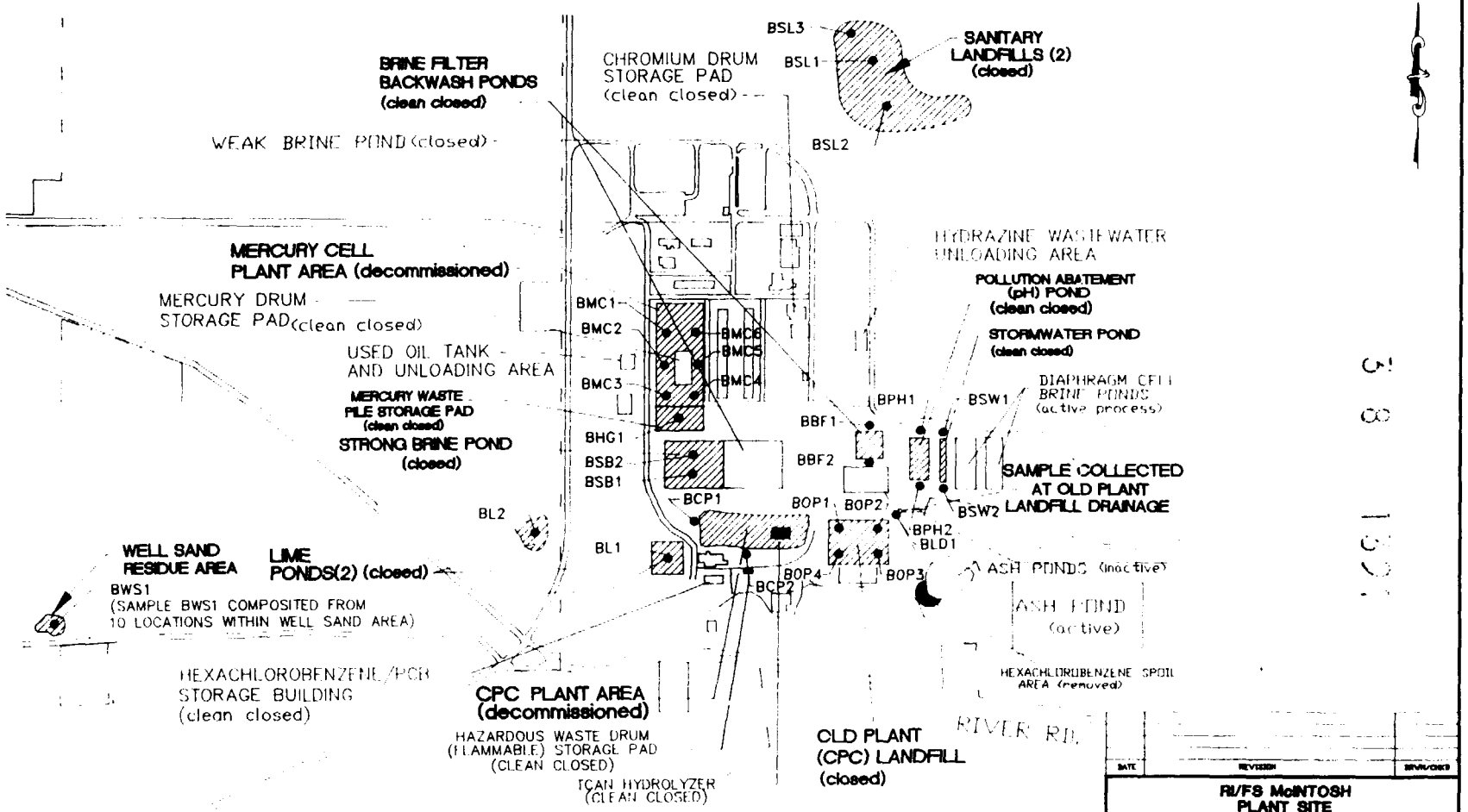
WOODWARD-CLYDE CONSULTANTS
Consulting Engineers, Geologists and Environmental Scientists
Baton Rouge, Louisiana

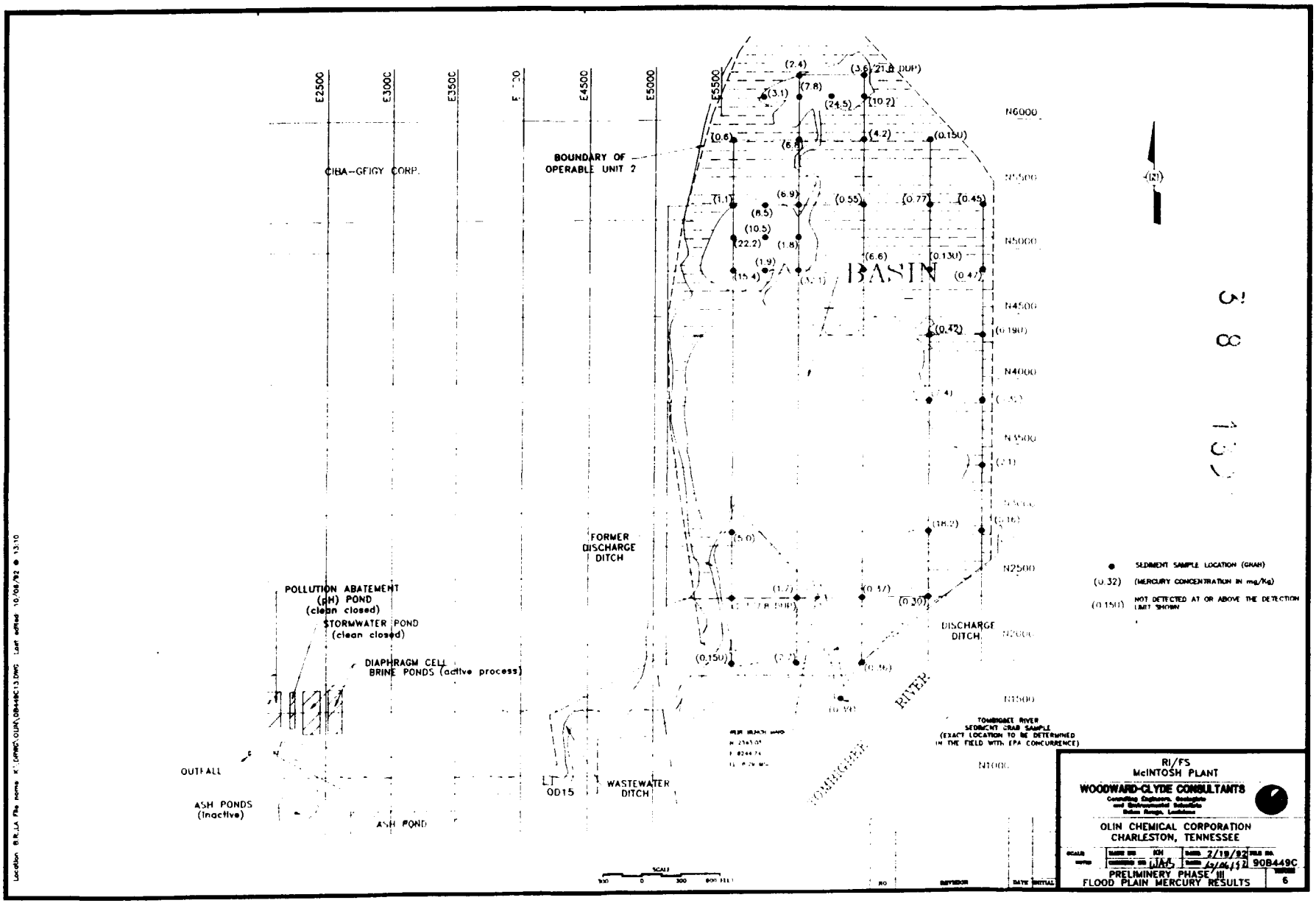
OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE

SCALE AS SHOWN | DATE 4/11/92

ESTIMATED HORIZONTAL EXTENT OF CHLOROFORM IN GROUNDWATER

FIGURE 4


BSL3
SANITARY LANDFILLS (2) (closed)
BSL1
BRINE FILTER BACKWASH PONDS (clean closed)
CHROMIUM DRUM STORAGE PAD (clean closed)
WEAK BRINE POND (closed)
BSL2
HYDRAZINE WASTEWATER UNLOADING AREA
MERCURY CELL PLANT AREA (decommissioned)
POLLUTION ABATEMENT (pH) POND (clean closed)
MERCURY DRUM STORAGE PAD (clean closed)
BMC1
BMC2
BMC6
BMC5
STORMWATER POND (clean closed)
USED OIL TANK AND UNLOADING AREA
BMC3
BMC4
DIAPHRAGM CELL BRINE PONDS (active process)
BPH1
BSW1
MERCURY WASTE PILE STORAGE PAD (clean closed)
BBF1
STRONG BRINE POND (closed)
BHG1
BSB2
BSB1
BBF2
SAMPLE COLLECTED AT OLD PLANT LANDFILL DRAINAGE
BCP1
BOP1
BOP2
BSW2
BL2
BPH2
BLD1
WELL SAND RESIDUE AREA
LIME PONDS(2) (closed)
BL1
BOP4
BOP3
ASH PONDS (inactive)
BCP2
BWS1
(SAMPLE BWS1 COMPOSITED FROM 10 LOCATIONS WITHIN WELL SAND AREA)
ASH POND (active)
HEXACHLOROBENZENE/PCB STORAGE BUILDING (clean closed)
HEXACHLOROBENZENE SPOIL AREA (removed)
CPC PLANT AREA (decommissioned)
HAZARDOUS WASTE DRUM (FLAMMABLE) STORAGE PAD (CLEAN CLOSED)
OLD PLANT (CPC) LANDFILL (closed)
RIVER RD
TCAN HYDROLYZER (CLEAN CLOSED)
LEGEND
SWMU/AOC SAMPLED
BORING/SAMPLE LOCATION
DATE
REVISION
BY/CHKD
RI/FS McINTOSH PLANT SITE
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Baton Rouge, Louisiana
OLIN CHEMICAL CORP.
CHARLESTON, TENNESSEE
SCALE: NTS
DRAWN BY: PY
DATE: 8/92
FILE NO. 9084460
CHECKED BY: WAB
DATE: 10/04/92
PHASE III SAMPLE LOCATIONS OPERABLE UNIT 1
FIGURE 5


E2500
E3000
E3500
E4000
E4500
E5000
E5500
N6000
N5500
N5000
N4500
N4000
N3500
N3000
N2500
N2000
N1500
N1000
CIBA-GEIGY CORP.
BOUNDARY OF OPERABLE UNIT 2
FORMER DISCHARGE DITCH
POLLUTION ABATEMENT (pH) POND (clean closed)
STORMWATER POND (clean closed)
DIAPHRAGM CELL BRINE PONDS (active process)
OUTFALL
ASH PONDS (inactive)
ASH POND
LT OD15
WASTEWATER DITCH
DISCHARGE DITCH
TOMBIGBEE RIVER
TOMBIGBEE RIVER SEDIMENT GRAB SAMPLE (EXACT LOCATION TO BE DETERMINED IN THE FIELD WITH EPA CONCURRENCE)
SEDIMENT SAMPLE LOCATION (GRAB)
(0.32) (MERCURY CONCENTRATION IN mg/Kg)
(0.150) NOT DETECTED AT OR ABOVE THE DETECTION LIMIT SHOWN
RI/FS
McINTOSH PLANT
WOODWARD-CLYDE CONSULTANTS
OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE
PRELIMINERY PHASE III
FLOOD PLAIN MERCURY RESULTS
90B449C
6

3 8 1993

APPENDIX A

REVISED LIST OF CANDIDATE TECHNOLOGIES

TABLE A-1

CANDIDATE TECHNOLOGIES FOR OU-1 GROUNDWATER
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Containment				
Capping				
Clay Cap	X	X	Compacted clay covered with soil over areas of contamination.	Could possibly be implemented with the existing data.
Asphalt	X	X	Spray application of a layer of asphalt.	(Same as above.)
Concrete	X	X	Installation of concrete slabs over areas of contamination.	(Same as above.)
Multimedia Cap	X	X	Clay and synthetic membrane covered by soil over areas of contamination.	(Same as above.)
Vertical barriers				
Sheet Piling	X	X	Sheet piles act as low-permeability subsurface barrier walls that either contain, capture, or redirect groundwater flow at the site. Sheet piles can be made of wood, pre-cast concrete, or steel. Steel piles are the most effective in terms of groundwater cut-off and cost.	Additional hydrogeological and geotechnical investigations may have to be conducted.
Slurry Walls	X	X	Slurry walls act as low-permeability subsurface barrier walls that either contain, capture, or redirect groundwater flow at the site. Soil-bentonite slurry walls are the most common slurry walls. Less common are the cement-bentonite and or concrete (diaphragm) walls.	(Same as above.)

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TABLE A-1 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 GROUNDWATER
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Grouting	X	X	A process whereby one of a variety of fluids is injected into a rock or soil mass where it is set in place to reduce water flow and strengthen the formation. Grouting includes such technologies as rock grouting, and grout curtains.	Additional hydrogeologic and geotechnical investigation would probably be required.
Horizontal Barriers				
Grout Injection	X	X	Drilling through the site and injecting a grout to form a horizontal or curved barrier to prevent the downward migration of contaminants.	Additional hydrogeologic and geotechnical invesigation would probably be required.
Block Displacement	X	X	Displacement and bottom sealing of a block of earth isolatede by perimeter barriers, by continued grout or slurry pumping to prevent the downward migration of contaminants.	(Same as above.)
Groundwater Removal				
Subsurface Drains				
Interceptor drain	X	X	Any conduit buried underground to collect and convey aqueous discharges by gravity flow. Manholes or wet wells are used to collect the flow conveyed by the conduits and pump the discharge aboveground to the treatment system.	Could possibly be implemented with the existing data.

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TABLE A-1 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 GROUNDWATER
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Extraction				
Additional Wells	X	X	Installation of additional extraction wells to accelerate contaminant reduction.	Could possibly be implemented with the existing data.
Injection Wells	X	X	Installation of injection wells to accelerate contaminant reduction.	
Horizontal Wells	X	X	An innovative technology in which wells are installed horizontal. Can have greater lateral influence than conventional extraction wells. Would be installed to accelerate contaminant reduction either as groundwater extraction or vapor extraction wells.	(Same as above.)
Enhanced Extraction				
Steam Injection		X	Steam is injected into the subsurface soils to enhance the removal of volatile and semi-volatile organics. Technology is applicable for subsurface soils present above or below the groundwater table. Extraction wells pump and treat groundwater and transport steam and vaporized contaminants under vacuum to the surface.	Bench and/or pilot scale treatability testing would probably be required.

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TABLE A-1 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 GROUNDWATER
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Vapor Extraction		X	Volatile organics present in the subsurface soils are extracted by a series of injection/ extraction wells. The vapors are extracted by applying either vacuum or pressure or a combination of both. This technology is applicable only for subsurface soils above the water table.	Bench and/or pilot scale treatability testing would probably be required.
Solvent Injection		X	Injection of solvents into the groundwater to dissolve and mobilize the organic contaminants - To improve the effectiveness of Pump & Treat system.	(Same as above.)
Surfactant Injection	X	X	Injection of surfactant into the groundwater to dissolve and mobilize inorganics and organics - To improve the effectiveness of Pump & Treat system.	Bench and/or pilot scale treatability testing would probably be required.
Groundwater Treatment				
Physical/Chemical Treatment				
Air Stripping		X	A means of treating contaminated water by transferring the contaminants from the aqueous phase to the air phase	Technology can commonly be evaluated without treatability testing.

Woodward-Clyde Consultants

TABLE A-1 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 GROUNDWATER
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Steam Stripping		X	Is a unit process that uses steam to extract organics from aqueous streams. Can be considered as an alternative to air stripping, if the concentrations of the contaminants are too high or the volatility of the contaminants is too low for air stripping to be effective.	Technology can commonly be evaluated without treatability testing.
Activated Carbon Adsorption	X[1]	X	Is a surface phenomenon in which soluble molecules from a solution are bonded onto a particular substrate.	Technology can commonly be evaluated without treatability testing.
Dissolved Air Flotation	X	X	Separation of solids in a suspension by injecting pressurized air.	Bench and/or pilot scale treatability testing would probably be required.
Filtration	X	X	Removal of suspended solids from a fluid by passage of the fluid through a bed of granular material	(Same as above.)
Precipitation/Flocculation/ Sedimentation	X		A combination of technologies used to remove inorganics from solution by precipitation, conglomeration, and gravity settling or sedimentation	(Same as above.)
Membrane Technology	X	X	A general term for various membrane processes (Reverse Osmosis, Ultrafiltration, Hyperfiltration, and Electrodialysis) to separate dissolved and suspended material from water. Reverse Osmosis and Ultrafiltration have greater potential for use in site remediation processes than the other membrane processes	(Same as above.)

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TABLE A-1 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 GROUNDWATER
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Ion Exchange	X	X	Anions and cations in a dilute aqueous waste are removed from solution through the process of ion exchange	Bench and/or pilot scale treatability testing would probably be required.
Distillation		X	A unit process that separates components of a liquid or sludge mixture by partially vaporizing the mixture and separately recovering the vapors and residue	(Same as above.)
Oxidation/Reduction	X	X	Involves the chemical transformation of reactants in which the oxidation state of one reactant is raised while the other is lowered	(Same as above.)
Neutralization	X		Neutralization is the interaction of an acid or a base with a solution to adjust the pH of the solution to the desired levels	Technology can commonly be evaluated without treatability testing.
Biological Treatment				
Aerobic		X	Degradation of organics using microorganisms in an aerobic environment	Bench-scale treatability testing would probably be required. Pilot-scale treatability testing may be performed as an extension of bench-scale studies.
Anaerobic		X	Degradation of organics using microorganisms in an anaerobic environment	(Same as above.)

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3 8 1699

TABLE A-1 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 GROUNDWATER
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
In Situ Treatment				
Bioreclamation		X	System of injection and recovery wells introduce bacteria and nutrients to degrade contamination	Bench-scale treatability testing would probably be required. Pilot-scale testing may be performed as an extension of bench-scale studies.
Groundwater Disposal				
Discharge				
Surface Discharge	X	X	Discharge through existing NPDES outfall.	Sufficient data available.
Subsurface Discharge	X	X	Injection into subsurface zones.	Hydrogeologic investigation may have to be performed.

NOTES:

[1] Applicable to mercury.

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TABLE A-2

CANDIDATE TECHNOLOGIES FOR OU-1 SOILS
OLIN MCINTOCH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Containment				
Capping				
Clay Cap	X	X	Compacted clay covered with soil over areas of contamination.	Could possibly be implemented with the existing data.
Asphalt	X	X	Spray application of a layer of asphalt.	(Same as above.)
Concrete	X	X	Installation of concrete slabs over areas of contamination.	(Same as above.)
Multimedia Cap	X	X	Clay and synthetic membrane covered by soil over areas of contamination.	(Same as above.)
Vertical barriers				
Sheet Piling	X	X	Sheet piles act as low-permeability subsurface barrier walls that either contain, capture, or redirect groundwater flow at the site. Sheet piles can be made of wood, pre-cast concrete, or steel. Steel piles are the most effective in terms of groundwater cut-off and cost.	Additional hydrogeological and geotechnical investigation may have to be conducted.
Slurry Walls	X	X	Slurry walls act as low-permeability subsurface barrier walls that either contain, capture, or redirect groundwater flow at the site. Soil-bentonite slurry walls are the most common slurry walls. Less common are the cement-bentonite and or concrete (diaphragm) walls.	(Same as above.)

Woodward-Clyde Consultants

TABLE A-2 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 SOILS
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Grouting	X	X	A process whereby one of a variety of fluids is injected into a rock or soil mass where it is set in place to reduce water flow and strengthen the formation. Grouting includes such technologies as rock grouting, and grout curtains including vibrating beam.	Additional hydrogeological and geotechnical investigation would probably be required.
Horizontal Barriers				
Grout Injection	X	X	Drilling through the site and injecting a grout to form a horizontal or curved barrier to prevent the downward migration of contaminants.	Additional hydrogeological and geotechnical investigation would probably be required.
Block Displacement	X	X	Displacement and bottom sealing of a block of earth isolated by perimeter barriers, by continued grout or slurry pumping to prevent the downward migration of contaminants.	(Same as above.)
Soil Treatment				
Encapsulation/Fixation				
Stabilization/Solidification	X	X	A technology by which the mobility of a chemical waste is reduced by either physically entrapping the waste and/or changing its chemical state. This technology can be categorized by the primary stabilizing agent used: cement-based, pozzolanic- or silicate based, thermoplastic-based, or organic polymer-based.	Bench scale testing would probably be required. Pilot scale testing may not be required.

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3 8 1401

TABLE A-2 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 SOILS
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Physical/Chemical Treatment				
Basic Extraction Sludge Treatment (BEST®)		X	Is a solvent extraction process that uses one or more secondary or tertiary amines (usually triethylamine [TEA]) to separate organics from soils and sludges.	Bench and/or pilot scale testing would probably be required.
Liquified Gas		X	Liquified gas is used as solvent to extract organics from sludges, contaminated soils, and wastewater. Carbon dioxide is used for wastewaters and propane is used for sludges and contaminated soil.	(Same as above.)
Low-Energy Solvent Extraction Process (LEEP℠)		X	Uses common organic solvents to extract and concentrate organic pollutants from soils, sediments, and sludges.	(Same as above.)
APEG-PLUS™		X	Similar to APEG™. Specifically uses potassium hydroxide and dimethyl sulfoxide to aid dehalogenation.	(Same as above.)
Oxidation/Reduction	X	X	Process is applied to destroy hazardous waste components or convert the hazardous components to less hazardous forms by raising the oxidation state of one reactant and lowering that of the another.	(Same as above.)

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3 6 1403

TABLE A-2 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 SOILS
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Soil Washing	X	X	Process extracts contaminants from sludge, soil, or sediment medium as the washing fluid. The washing fluid may be composed of water, organic solvents, water/chelating agents, water/surfactants, acids or bases, depending on the contaminant to be removed.	Bench and/or pilot scale testing would probably be required.
Thermal				
Fluidized Bed		X	Waste is injected into a hot agitated bed of sand whereby combustion occurs.	Thermal destruction technologies generally do not required treatability testing. However, parameters such as heat value, chlorine content, metal content and destruction efficiency may be required.
Circulating Bed Combustor		X	Variation of fluidized bed incinerator - Uses higher air velocity and circulating solids to create a larger and highly turbulent combustion zone.	(Same as above.)
Rotary Kiln		X	Involves the controlled combustion of organic wastes under net oxidizing conditions.	(Same as above.)
Infrared		X	Uses silicon carbide elements to generate thermal radiation beyond the red end of the visible spectrum.	(Same as above.)
Pyrolysis	X	X	Destruction of organic material in the absence of oxygen at a higher temperature.	(Same as above.)
Vitrification	X	X	A process by which organics are destroyed and inorganics are immobilized into a natural obsidian.	(Same as above.)

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TABLE A-2 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 SOILS
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Advanced Electric Reactor	X	X	Uses electrically heated fluid walls to pyrolyze waste. Inorganic compounds melt and are fused into vitreous solids.	Thermal destruction technologies generally do not required treatability testing. However, parameters such as heat value, chlorine content, metal content and destruction efficiency may be required.
Thermal Desorption		X	Uses heat in a controlled environment to cause various organic compounds to volatilize and thereby be removed from contaminated material.	Bench and/or pilot scale treatability testing would probably be required.
Biological				
Aerobic		X	Degradation of organics using microorganisms in an aerobic environment.	Bench scale treatability - testing would probably be required. Pilot scale treatability testing may be performed as an extension of bench scale studies.
Anaerobic			Degradation of organics using microorganisms in an anaerobic environment.	(Same as above.)
Slurry Phase			Excavated soil, sludge, or sediment is mixed with water to form a slurry that is agitated with environment amenable to biodegradation. Slurry is dewatered and the solids are disposed upon completion of the process.	(Same as above.)
Solid Phase			Excavated soils are placed on a lined treatment bed, tank, or building. Microbial growth is facilitated by adding nutrients and other additives into the soil. Air and water may also be supplied to the soil.	(Same as above.)

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TABLE A-2 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 SOILS
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
In Situ				
Bioreclamation		X	System of injection and recovery wells introduce bacteria and nutrients to degrade contamination.	Bench scale treatability - testing would probably be required. Pilot scale treatability testing may be performed as an extension of bench scale studies.
Soil Flushing	X	X	An in situ process where the zone of contamination is flooded with water or a water-surfactant mixture in order to dissolve and mobilize the contaminants. Contaminants are then brought to the surface by a series of extraction wells.	Bench and/or pilot scale treatability testing would probably be required.
Vacuum and Steam Extraction		X	Volatile organics present at the site are extracted by a series of injection/extraction wells. The vapors are extracted by applying either vacuum or pressure or a combination of both. Steam is also injected to raise the soil temperature and thereby enhance the recovery of the organics.	(Same as above.)
Vitrification	X	X	Is an in situ process whereby the soil and waste is melted into a glassy, solid matrix resistant to leaching and more durable than granite or marble. Organics are destroyed and inorganics are immobilized.	Initially would required bench scale testing to determine effectiveness for matrix and chemicals of concern. May also required pilot-scale testing to evaluate applicability to in situ conditions.

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3 6 140

TABLE A-2 (Continued)

CANDIDATE TECHNOLOGIES FOR OU-1 SOILS
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Stabilization/Solidification	X	X	An in situ process in which stabilizing/solidifying agents are added to the soil to reduce the mobility of chemicals by either physically entrapping them or changing their chemical state.	Initially would require bench scale testing to determine the appropriate additives and mix ratios. May also require pilot-scale testing to evaluate applicability to in situ conditions.
Chemical Treatment	X	X	A process by which a wide range of treatment agents, including precipitating and neutralizing chemicals, oxidizing/reducing agents, dechlorinating and chelating agents are delivered directly to the waste source.	Bench and/or pilot scale treatibility testing would probably be required.

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TABLE A-3

CANDIDATE IN SITU TREATMENT TECHNOLOGIES
OU-2 SEDIMENTS
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Fixation/Encapsulation				
Containment				
Soil Capping	X	X	Involves the placement of imported sediment over existing sediments by pumping from a barge or dredge through a diffuser head over the sediment.	May require a hydrodynamic investigation to evaluate the feasibility of placing the material and the potential for erosion.
Multimedia Capping	X	X	Provides for a submerged cover system consisting of a geotextile, Fabriform® liner, crushed aggregate and cover soil.	(Same as above)
Backfilling	X	X	A form of containment that consists of covering the sediments to an above-grade elevation.	(Same as above)
Natural Sedimentation	X	X	Consists of allowing the natural processes within the water body to continue depositing new sediments long-term and monitoring of the sedimentation process with respect to fish, water and sediments.	Would require a more detailed evaluation of the hydrodynamics of the basin including sedimentation rates and evaluation of sediment transport at different water elevations in the basin and the adjacent Tombigbee River.
Enhanced Sedimentation	X	X	Structures such as gabion blocks or similar materials or an earthen dam which can be placed in submerged conditions serve to impede the movement of water and thereby trap sediments to enhance the natural sedimentation process.	In addition to the hydrodynamic evaluation described above, pilot-scale testing would probably be required.

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3 8 1400

TABLE A-3 (Continued)

CANDIDATE IN SITU TREATMENT TECHNOLOGIES
OU-2 SEDIMENTS
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Expedited Sedimentation	X	X	Consists of providing a means of accelerating sedimentation by reworking the water body banks. The bank is scarified and a geotextile is placed and covered with erodible soils to expedite the sedimentation process.	In addition to the hydrodynamic evaluation described above, pilot-scale testing would probably be required.
Solidification/Stabilization				
Lime-Based Pozzolan	X	X	Addition of siliceous materials combined with a settling agent such as lime, cement or gypsum.	Initially would require bench-scale testing to determine the appropriate additives and mix ratios. May also require pilot-scale testing to evaluate applicability to in-situ conditions.
Portland Cement Pozzolan	X	X	Mixes waste with cement to incorporate the waste into the cement matrices.	(Same as above)
Cement Overlay	X	X	Portland cement pozzolanic reaction at interface, then overlay with concrete to line ditch.	(Same as above)
Asphalt-Based	X	X	Mixing of heated dried waste within an asphalt bitumen, paraffin or polyethylene matrix.	(Same as above)
Pozzolan-Based Clay		X	Utilizes a pozzolanic-based product containing clay.	(Same as above)
Quicklime		X	Utilizes CaOH mixed with the contaminated material.	(Same as above)

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TABLE A-3 (Continued)

CANDIDATE IN SITU TREATMENT TECHNOLOGIES
OU-2 SEDIMENTS
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Polymerization		X	Catalysts convert monomers to polymers which often have greater stability.	(Same as above)
Chemical Immobilization	X	X	Metals stabilized as insoluble precipitate, certain organic monomers can be stabilized as polymers.	Initially would require bench-scale testing to determine the appropriate additives and mix ratios. May also require pilot-scale testing to evaluate applicability to in-situ conditions.
Thermal Treatment				
Vitrification	X	X	Destruction of organics. Immobilization of metals.	Initially would require bench-scale testing to determine effectiveness for matrix and chemicals of concern. May also require pilot-scale testing to evaluate applicability to in-situ conditions.
Radio Frequency		X	Organics are destroyed or mobilized by vaporization, thermal decomposition, or distillation.	(Same as above)
Chemical Treatment				
Reduction/Oxidation	X	X	Reduces or oxidizes most organics and certain metals. Considerable amount of residuals treatment is required.	Bench-scale or pilot-scale treatability testing would probably be required.
Alkali Metal Dechlorination		X	Dechlorination of organics by affinity for alkali metals on filtered or dewatered material.	(Same as above)

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TABLE A-3 (Continued)

CANDIDATE IN SITU TREATMENT TECHNOLOGIES
OU-2 SEDIMENTS
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Physical Treatment				
Vacuum/Steam Extraction		X	Recover organics for further treatment or disposal with Henry's constant >0.001 atm·m^3/mole.	(Same as above)
Soil Washing/Flushing	X	X	Requires solubility of contaminants in a solvent to flush contaminants from subsurface strata.	Bench-scale or pilot-scale treatability testing would probably be required.
Biological Treatment				
Biodegradation		X	Utilizes bacteria for the degradation of organics, often used in conjunction with a groundwater pumping system.	Bench-scale treatability testing would probably be required. Pilot-scale treatability testing may be performed as an extension of bench-scale studies.

Applicable to:

X = Technology is applicable to indicated chemical group

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TABLE A-4

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Fixation/Encapsulation				
The containment alternatives of soil capping and multimedia capping and the aforementioned solidification/stabilization alternatives with the exception of cement overlay are applicable as a direct waste treatment technology.				See comments in Fixation/Encapsulation section of Table 3. Pilot-scale testing would probably not be required for fixation/encapsulation as direct waste treatment technologies.
Thermal Treatment				
Combustion				
Fluidized Bed		X	Consists of a bed of inert, granular, sand-like material, combustion air is forced upward through the bed, which fluidizes the material at a minimum critical velocity.	Thermal destruction technologies generally do not require treatability testing. However, parameters such as heat value, chlorine content, metal content and destruction efficiency may be required.
Circulating Bed Combustion		X	Variation of fluidized bed, uses higher air velocity and circulating solids to create a larger and highly turbulent combustion zone.	(Same as above)
Two Stage, Fluidized Bed/Cyclonic Incinerator	X	X	Combine fluidized bed with cyclonic combustion. Inorganic contaminants will be encapsulated in glassy leach-resistant agglomerates.	(Same as above)

TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Low Temperature Fluidized Bed		X	Eliminates the use of refractory materials in combustion chamber that requires periodic replacement. Air and nitrogen are used to fluidize the carbonate/catalyst bed.	Thermal destruction technologies generally do not require treatability testing. However, parameters such as heat value, chlorine content, metal content and destruction efficiency may be required.
Rotary Kiln		X	Involves the controlled combustion of organic wastes under net oxidizing conditions.	(Same as above)
Pyretron® (Rotary Kiln)		X	Combustion central system that uses oxygen or oxygen-enriched air to improve process control while significantly increasing incineration throughput.	(Same as above)
Wet Air Oxidation		X	Breaks down suspended and dissolved oxidizable inorganic and organic materials by oxidation in a high-temperature, high-pressure, aqueous environment.	(Same as above)
Supercritical Water Oxidation	X	X	The process is based on the ability of water to perform as an excellent solvent for organics when it is above its critical temperature (705°F) and pressure (3,200 psi). Inorganic salts become insoluble above 930°F, and precipitate.	(Same as above)

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Molten Salt		X	A method of burning organic material while, at the same time, sorbing objectionable by-products of combustion from the effluent gas stream.	Thermal destruction technologies generally do not require treatability testing. However, parameters such as heat value, chlorine content, metal content and destruction efficiency may be required.
Molten Glass	X	X	Uses a pool of molten glass as the heat transfer mechanism. Ash and inorganic residue are captured in the glass.	(Same as above)
Turbulator		X	High-turbulence combustion system designed to handle liquid wastes.	(Same as above)
Pedco Cascading		X	Able to handle viscous and high-solids-content wastes, originally developed for destruction of low-Btu hazardous wastes, has been adopted to allow for energy recovery as well.	(Same as above)
Gasification	X	X	Hydrocarbon gasification process to produce synthesis gas for use in chemical production and power generation. Waste material is suitable if slurried, high enough energy content, slagging temperature of ash is sustained.	(Same as above)

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Thermocatalytic		X	Catalyt , thermochemical process that converts aqueous organic wastes into a medium-Btu gas consisting mainly of methane and carbon dioxide.	(Same as above)
Catalytically Stabilized Thermal Combustor		X	Using a hot-walled tubular reactor and catalytic surface reactions, the combustor stabilizes gas-phase combustion in a near plug-flow pattern.	Thermal destruction technologies generally do not require treatability testing. However, parameters such as heat value, chlorine content, metal content and destruction efficiency may be required.
Linde® Oxygen Combustion		X	Increase throughput of conventional incinerators, uses a patented burner, flow-control piping, a control console and is designed to use up to 100 percent oxygen.	(Same as above)
Flame (Slagging) Reactor	X	X	A hydrocarbon-fueled, flash smelting system produces a decontaminated molten slag and a recyclable, heavy metal-enriched oxide.	(Same as above)
Vaporization Extraction System	X	X	Materials are mixed with hot gas in a co-current, stirred fluidized bed.	(Same as above)
Submerged Quench	X	X	Chamber is a vertical cylinder which allows removal of large amounts of material continuously. The outlet of the chamber into a submerged quench system.	(Same as above)

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
VEDA Solar		X	An array of sun-tracking mirrors concentrate and reflect the sun's radiant energy to a windowed reactor vessel to destroy hazardous organic wastes.	(Same as above)
Pyrolysis				
Infrared		X	Uses silicon carbide elements to generate thermal radiation beyond the red end of the visible spectrum.	Thermal destruction technologies generally do not require treatability testing. However, parameters such as heat value, chlorine content, metal content and destruction efficiency may be required.
Pyrolysis		X	Destruction of organic material in the absence of oxygen at a high temperature.	(Same as above)
AOSTRA Taciuk		X	Separates and recovers hydrocarbon from soil or inert solids.	(Same as above)
Pyro-Disintegrator™	X	X	Wastes are dewatered as an electric current is passed through a waste/flocculent mixture during pressure filtration. Residual solids enter an electric furnace where organics are destroyed and inorganic constituents are encapsulated.	(Same as above)

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Electric Pyrolyzer	X	X	Uses electrical energy to generate temperatures near 3,000°F in a low-oxygen or oxygen-free environment. Organics are pyrolyzed and inorganics are melted to form a glass-like residue.	(Same as above)
Vitrification	NV	X	Used to transform chemical and physical characteristics of hazardous waste such that the treated residues contain hazardous material immobilized in a vitreous mass.	Initially would require bench-scale testing to determine effectiveness for nature and chemicals of concern. May also require pilot-scale testing to evalaute applicability to direct waste treatment conditions.
Advanced Electric Reactor	X	X	Uses electrically heated fluid walls to pyrolyze waste. Inorganic compounds melt and are fused into vitreous solids.	Thermal destruction technologies generally do not require treatability testing. However, parameters such as heat value, chlorine content, metal content and destruction efficiency may be required.
Synthetica™ Detoxifier		X	Wastes are destroyed in the unit by a proprietary steam gasification process that uses electrical energy rather than open-flame combustion.	(Same as above)
HT-5 Distillation		X	Heats water in a nitrogen atmosphere to vaporize volatile and semivolatile compounds. Dry, granular solids generated during the process are inert.	(Same as above)

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Electric Melter Furnace	X	X	A high-temperature, non-flame furnace used for the production of glass from liquid or solid feeds with the addition of silicates.	(Same as above)
Plasma Arc Torch				
Plasma Torch		X	Functions by contacting the waste feed with a gas which has been energized into its plasma state by an electrical discharge.	(Same as above)
Pyroplasma		X	A plasma arc torch that operates at extremely high temperatures.	(Same as above)
Plasma Centrifugal		X	Uses a plasma torch to melt solids, destroy contaminants and produce a vitrified residue using a 6-foot-diameter reactor tub.	Thermal destruction technologies generally do not require treatability testing. However, parameters such as heat value, chlorine content, metal content and destruction efficiency may be required.
Al-Chem Detoxifier		X	Use electrically generated plasma to gasify and pyrolyze wastes where the plasma zone occurs at a submerged oil-water interface.	(Same as above)

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Chemical Treatment				
Chemical Extraction				
BEST® (Basic Extraction Sludge Treatment)		X	A secondary or tertiary amine is mixed at cool temperatures with soils or sludges, used primarily to treat oily sludges containing hydrocarbons and other high-molecular weight organics.	Bench-scale or pilot-scale treatability testing would probably be required.
Liquified Gas		X	Carbon dioxide and propane at high pressure are used to extract oils and organic solvents from sludge in a continuous process.	(Same as above)
Dehalogenation				
Alkali Metal Dechlorination		X	Dechlorination of organics by affinity for alkali metals on filtered or dewatered material.	(Same as above)
Catalytic Dechlorination		X	Based on the reaction of polychlorinated hydrocarbons with high pressure hydrogen gas in the presence at a catalyst. The feed must be either liquid or gaseous form with the inorganic and inert constituents removed.	Bench-scale or pilot-scale treatability testing would probably be required.
APEG™		X	Alkali metals and polyethylene glycols react rapidly to dehalogenate halo-organic compounds of all types.	(Same as above)

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
APEG-PLUS™		X	Same as above, plus the use of specifically potassium hydroxide and dimethyl sulfoxide to aid dehalogenation. Slurry is transferred to centrifuge to recover/recycle reagents.	(Same as above)
Reduction/Oxidation				
Reduction/Oxidation	X	X	Process is employed to destroy hazardous components or convert the hazardous components to less hazardous forms by raising the oxidation state of one reactant and lowering that of another.	(Same as above)
Electrolytic Oxidation	X		Cathodes and oxides are immersed in a tank containing a waste to be oxidized. Metals will plate on the cathodes when an electric current is imposed.	(Same as above)
Chemical Hydrolysis	X	X	Process of breaking a bond in a molecule so that it will go into ionic solution by the addition of chemicals, by irradiation or biologically. The cloven molecule can be further treated by other means to reduce toxicity.	Bench-scale or pilot-scale treatability testing would probably be required.

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Chelation				
Chelation	X		A chelating molecule is used to form ligands with metal ions and make it usable to form ionic salts which can precipitate. Used to keep metals in solution and to aid in dissolution for subsequent transport and removal.	(Same as above)
Physical Treatment				
Physical Extraction				
Soil Washing/Flushing	X	X	Process extracts contaminants from sludge or soil matrices using a liquid medium as the washing fluid. The washing fluid may be composed of water, organic solvents, water/chelating agents, water/surfactants, acids or bases, depending on the contaminant to be removed.	(Same as above)
Supercritical Fluid Extraction		X	At certain temperature and pressure, fluids reach their critical point, beyond which their solvent properties are greatly enhanced. Carbon dioxide is used to extract hazardous organics from aqueous streams.	Bench-scale or pilot-scale treatability testing would probably be required.

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
LEEP℠ (Low Energy Extraction Procedure)		X	Designed to remove organics from contaminated soil and sediment. Process produces decontaminated solid and water effluents and concentrates the contaminants in a small-volume solvent stream that can either be recycled or incinerated.	(Same as above)
Heavy Media Separation	X	X	Process for separating two solid materials which have significantly different absolute densities. Solids are placed in a fluid with a specific gravity so that the lighter solid floats while the heavier sinks.	(Same as above)
Centrifugation	X	X	Process in which the components of a fluid mixture are separated mechanically based on their relative density by rapidly rotating the fluid mixture within a rigid vessel.	(Same as above)
Aeration				
Aeration		V	Process involves the use of a vibratory screening and aeration system. Soil is passed over a series of screens with countercurrent air to promote volatilization.	(Same as above)
Mechanical Aeration/Extraction		V	Entails contacting clean air with the contaminated soils in order to transfer the volatile organics from the soil into the air stream for further treatment.	Bench-scale or pilot-scale treatability testing would probably be required.

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Low Temperature Thermal Stripping		V	The design processes contaminated soils through a pug mill or rotary drum system equipped with heat transfer surface. Generally used to remove volatile organics with a Henry's Law constant of at least 0.003 atm · m^3/mole from soils or similar solids.	(Same as above)
Sedimentation/Flotation				
Froth Flotation		X	Process scours contaminants from the surface of sand and larger particles and also concentrates the clay/silt fraction thereby reducing volume for further treatment.	(Same as above)
Froth Flotation and Solvent Extraction		X	Same as above with the addition of a mixture of polar and nonpolar solvents in three, countercurrent mixing stages designed to minimize the loss of solvent.	(Same as above)
Biological Treatment				
Aerobic Bacterial				
Aerobic Respiration		X	Organic molecules are oxidized to carbon monoxide and water and other end products using molecular oxygen as the terminal electron acceptor.	Bench-scale treatability testing would probably be required. Pilot-scale treatability testing may be performed as an extension of bench-scale studies.
Composting		X	Storage of highly biodegradable and structurally firm material with a small percentage of biodegradable waste.	Bench-scale treatability testing would probably be required. Pilot-scale treatability testing may be performed as an extension of bench-scale studies.

TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Slurry-Phase (*also has anaerobic bacterial application*)		X	Involves the treatment of contaminated soil or sludge in a large mobile bioreactor which maintains intimate mixing and contact of micro-organisms with the hazardous compounds.	(Same as above)
Solid-Phase		X	Process that treats soils in an above grade system using conventional soil management practices to enhance the microbial degradation of contaminants.	(Same as above)
Gas-Permeable Membranes		X	Provide bacterial cultures with a support base as well as a means of acquiring oxygen required for survival.	(Same as above)
Toxigon™		X	Designed to enhance the degradation of specific contaminants and to accelerate remediation using an emulsifier, a natural blend and a series of dehydrated microbes.	(Same as above)
Anaerobic Bacterial				
Anaerobic Respiration		X	Process achieves the reduction of organic matter, in an oxygen-free environment, to methane and carbon dioxide using facultative and obligate anaerobes.	(Same as above)

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TABLE A-4 (Continued)

CANDIDATE DIRECT WASTE TREATMENT TECHNOLOGIES
OU-1 SEDIMENT
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Algal				
Alga SORB●	X		The process is based on an algae species that has a very large number of bonding sites for heavy metals that differ in affinity and specificity.	Bench-scale treatability testing would probably be required. Pilot-scale treatability testing may be performed as an extension of bench-scale studies.
Mycological				
White-Rot Fungus		X	The lignin degrading white-rot fungus has been found to degrade a broad spectrum of organopollutants including chlorinated, aliphatic, aromatic-heterocyclic compounds.	(Same as above)

X = Technology is applicable to indicated chemical group
NV = Only applicable to non-volatile fraction of chemical group
V = Only applicable to volatile fraction of chemical group

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TABLE A-5

CANDIDATE PROCESS WATER TREATMENT TECHNOLOGIES
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Thermal Treatment				
All previous direct waste thermal treatment technologies previously listed are applicable				Thermal destruction technologies generally do not require treatability testing. However, prameters such as heat value, chlorine content, metal content and destruction efficiency may be required.
Chemical Treatment				
Reduction/Oxidation				
Ozonation	X	X	A chemical oxidation process appropriate for aqueous streams which contain less than 1 percent oxidizable compounds.	Bench-scale or pilot-scale treatability testing would probably be required.
Oxidation by Hypochlorite	X	X	Process consists of adding sodium or calcium hypochlorite to oxidize organic wastes.	(Same as above)
Oxidation by Hydrogen Peroxide	X	X	Based on the addition of hydrogen peroxide, an excellent oxidizing agent, to oxidize organic compounds.	(Same as above)
Ion Exchange	X		Process is usually based on the use of specifically formulated resins having an "exchangeable" ion bound to the resin with a "weak ionic" band.	(Same as above)
Ultraviolet Photolysis		X	A process that destroys or detoxifies hazardous chemicals in aqueous solutions utilizing UV irradiation.	(Same as above)

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TABLE A-5 (Continued)

CANDIDATE PROCESS WATER TREATMENT TECHNOLOGIES
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Solar-Driven Photocatalytic		X	Ultraviolet energy activates sites on the catalyst surface (titanium dioxide), causing the formation of reactive species which initiate further reaction that result in the complete oxidation and mineralization of the organic contaminants.	Bench-scale or pilot-scale treatability testing would probably be required.
Neutralization	X	X	Used to treat waste organic or inorganic wastestreams in order to reduce or eliminate their reactivity and corrosiveness.	(Same as above)
Adsorption				
Granular Activated Carbon (G.A.C.) Adsorption	X	X	Water is passed through a pressure vessel that contains granular activated carbon. Most organics, and many inorganics, will readily attach themselves to the carbon.	Technology can commonly be evaluated without treatability testing based on the water chemistry.
Resin Adsorption	X	X	Removes organic and inorganic constituents, regenerated in place with a liquid regenerant, producing a more concentrated spent regenerant stream which requires further treatment.	Bench-scale or pilot-scale treatability testing would probably be required.
Precipitation				
Precipitation	X	X	Acid or base is added to a solution to adjust the pH to a point where the constituents to be removed have their lowest solubility.	(Same as above)

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TABLE A-5 (Continued)

CANDIDATE PROCESS WATER TREATMENT TECHNOLOGIES
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Osmosis				
Reverse Osmosis	X	X	Application of high pressure will cause flow of solvent across a semipermeable membrane from a more dilute concentration to a more concentrated state thereby reducing the volume of organic and inorganic contaminants for further treatment.	Bench-scale or pilot-scale treatability testing would probably be required.
Electrodialysis				
Electrodialysis	X	X	Concentrates or separates ionic species by passing a water solution through alternately placed cation-permeable and anion-permeable membranes.	(Same as above)
Physical Treatment				
Aeration				
Air Stripping		V	A mass transfer process in which volatile contaminants in water or soils are evaporated into the air.	Technology can commonly be evaluated without treatability testing.
Steam Stripping		V	A continuous fractional distillation process carried out in a packed or tray tower that evaporates volatile organics from aqueous wastes.	(Same as above)

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TABLE A-5 (Continued)

CANDIDATE PROCESS WATER TREATMENT TECHNOLOGIES
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Sedimentation/Flotation				
Sedimentation	X	X	A gravity settling process which allows heavier solids to collect at the bottom of a containment vessel resulting in its separation from the suspending fluid.	Bench-scale or pilot-scale treatability testing would probably be required.
Flocculation	X	X	Used to enhance sedimentation or centrifugation. Flocculants adhere readily to suspended solids and with each other so that the resultant particles are too large to remain in suspension.	Bench-scale or pilot-scale treatability testing would probably be required.
Dissolved Air Flotation (pressurized) or Induced Air Flotation (at atmospheric pressure)	X	X	Process whereby suspended particles or mixed liquids can be removed from an aqueous waste stream by saturation with air. As air comes out of solution, microbubbles form which can readily absorb to particles enhancing their flotation characteristics.	(Same as above)
Filtration				
Filtration	X	X	A process of separating and removing suspended solids from a liquid by passing the liquid through a porous medium.	Bench-scale or pilot-scale treatability testing would generally not be required.
Micellar-Enhanced Ultrafiltration	X	X	The addition of surfactants to wastewaters enhance ultrafiltration and is applicable to wastewater containing lower molecular weight (<300 m.w.) organics and heavy metals.	(Same as above)

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TABLE A-5 (Continued)

CANDIDATE PROCESS WATER TREATMENT TECHNOLOGIES
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Granular Media Filtration	X	X	Uses gravity to remove solids from a fluid by passage through a bed of granular material.	(Same as above)
Membrane Permeation				
Emulsion Liquid Membrane Separation		X	Process concentrates contaminants into a reduced-volume product stream for disposal or recycling. Current research is focusing on the treatment of wastewaters containing low concentrations of phenols.	Bench-scale or pilot-scale treatability testing would probably be required.
Composite Membranes		X	Technology utilities composite semi-permeable membranes that are more permeable to organics than to water.	(Same as above)
Distillation				
Distillation	X	X	Process of evaporation followed by condensation whereby separation of volatile materials can be optionized by controlling the evaporation stage temperature and pressure and the condense temperature.	(Same as above)
Biological Processes				
All direct waste biological treatment technologies previously listed apply to an aqueous matrix with the exception of composting and solid-phase.				Bench-scale treatability testing would probably be required. Pilot-scale treatability testing may be performed as an extension of bench scale studies.

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TABLE A-5 (Continued)

CANDIDATE PROCESS WATER TREATMENT TECHNOLOGIES
OLIN MCINTOSH SITE
MCINTOSH, ALABAMA

	Applicable To		Description	Additional Data Requirements
	Metals	Organics		
Aerobic Bacterial				
Activated Sludge		X	Breaks down organic contaminants in aqueous waste streams through the activity of aerobic microorganisms which metabolize biodegradable organics.	(Same as above)
Rotating Biological Contactor		X	Process consists of primary treatment for solids removal followed by the contactors where the waste stream comes into contact with the microbial film and the atmosphere.	Bench-scale treatability testing would probably be required. Pilot-scale treatability testing may be performed as an extension of bench scale studies.
Anaerobic Bacterial				
Heavy Metal Removal	X		Spore form of bacteria has the ability to remove heavy metals from contaminated wastewaters. Removal mechanisms include adsorption, bioaccumulation, metal reduction and conversion to insoluble metal sulfides.	(Same as above)

X = Technology is applicable to indicated chemical group
V = Only applicable to volatile fraction of chemical group

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APPENDIX B

SUMMARY OF PHASE III PRELIMINARY DATA

Preliminary Data

CPC Plant - Volatiles

3 8 1433

Sample Id	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
BCP104	2-BUTANONE	6 J	2-4
BCP104	ACETONE	23 B	2-4
BCP104	BENZENE	3 J	2-4
BCP104	CARBON DISULFIDE	2 J	2-4
BCP104	CHLOROBENZENE	540 D	2-4
BCP104	METHYLENE CHLORIDE	11 BJ	2-4
BCP110	2-BUTANONE	2 J	8-10
BCP110	ACETONE	7 BJ	8-10
BCP110	CARBON DISULFIDE	19	8-10
BCP110	CHLOROBENZENE	86	8-10
BCP110	CHLOROFORM	7 J	8-10
BCP110	METHYLENE CHLORIDE	10 BJ	8-10
BCP114	2-BUTANONE	4 J	12-14
BCP114	ACETONE	19 B	12-14
BCP114	CHLOROBENZENE	400 D	12-14
BCP114	CHLOROFORM	5 J	12-14
BCP114	METHYLENE CHLORIDE	10 BJ	12-14
BCP114	TETRACHLOROETHENE	1 J	12-14
BCP132	2-BUTANONE	6 BJ	30-32
BCP132	ACETONE	19 B	30-32
BCP132	METHYLENE CHLORIDE	9 BJ	30-32
BCP132DUP	2-BUTANONE	7 BJ	30-32
BCP132DUP	ACETONE	10 BJ	30-32
BCP132DUP	METHYLENE CHLORIDE	8 BJ	30-32
BCP204	2-BUTANONE	8 BJ	2-4
BCP204	ACETONE	14 B	2-4
BCP204	CHLOROFORM	2 J	2-4
BCP204	METHYLENE CHLORIDE	15 B	2-4
BCP210	2-BUTANONE	8 BJ	8-10
BCP210	ACETONE	12 BJ	8-10
BCP210	CHLOROFORM	8 J	8-10
BCP210	METHYLENE CHLORIDE	13 B	8-10
BCP216	2-BUTANONE	7 BJ	14-16
BCP216	ACETONE	12 B	14-16

Preliminary Data

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CPC Plant - Volatiles

Sample Id	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
BCP216	METHYLENE CHLORIDE	11 BJ	14-16
BCP220	2-BUTANONE	7 BJ	18-20
BCP220	ACETONE	7 BJ	18-20
BCP220	CARBON DISULFIDE	2 J	18-20
BCP220	METHYLENE CHLORIDE	9 BJ	18-20

Qualifiers

B - Compound found in both the associated blank and the sample.

J - Estimated quantity.

D - Compound identified in diluted sample analysis.

Note: Only detected compounds are listed.

Preliminary Data

CPC Plant - Semivolatiles

Sample ID	Parameter	Reported Conc. (UG/KG)		Depth (FEET)
BCP104	1,2,4,5-TETRACHLOROBENZENE	740		2-4
BCP104	1,2,4-TRICHLOROBENZENE	1300		2-4
BCP104	BIS(2-ETHYLHEXYL)PHTHALATE	54	BJ	2-4
BCP104	HEXACHLOROBENZENE	200	J	2-4
BCP110	1,2,4,5-TETRACHLOROBENZENE	750000	D	8-10
BCP110	1,2,4-TRICHLOROBENZENE	700000	D	8-10
BCP110	1,2-DICHLOROBENZENE	30000		8-10
BCP110	1,3-DICHLOROBENZENE	2500	J	8-10
BCP110	1,4-DICHLOROBENZENE	24000		8-10
BCP110	HEXACHLOROBENZENE	75000		8-10
BCP114	1,2,4,5-TETRACHLOROBENZENE	9900	D	12-14
BCP114	1,2,4-TRICHLOROBENZENE	8500	D	12-14
BCP114	1,2-DICHLOROBENZENE	3500	D	12-14
BCP114	1,3-DICHLOROBENZENE	220	J	12-14
BCP114	1,4-DICHLOROBENZENE	2200		12-14
BCP114	HEXACHLOROBENZENE	8000	D	12-14
BCP132	1,2,4,5-TETRACHLOROBENZENE	55	J	30-32
BCP132	BIS(2-ETHYLHEXYL)PHTHALATE	38	BJ	30-32
BCP132	HEXACHLOROBENZENE	1500		30-32
BCP132DUP	HEXACHLOROBENZENE	300	J	30-32
BCP204	BIS(2-ETHYLHEXYL)PHTHALATE	57	BJ	2-4
BCP204	HEXACHLOROBENZENE	130	J	2-4
BCP210	ALL ANALYTES QUALIFIED AS U			8-10
BCP216	BIS(2-ETHYLHEXYL)PHTHALATE	37	BJ	14-16
BCP220	ALL ANALYTES QUALIFIED AS U			18-20

Preliminary Data

CPC Plant - Semivolatiles

Qualifiers

B - Compound found in both the associated blank and the sample.

J - Estimated quantity.

D - Compound identified in diluted sample analysis.

U - Analyzed for but not detected.

Note: Only detected compounds are listed.

Preliminary Data

CPC Plant - Pesticides/PCBs

Sample Id	Parameter	(UG/KG)	(UG/KG)	(FEET)
BCP104	ALPHA-BHC	17.0		2-4
BCP104	BETA-BHC	2.4 P		2-4
BCP110	4,4'-DDD	17.0 P	41.0 U	8-10
BCP110	4,4'-DDE	7.2 P	41.0 U	8-10
BCP110	4,4'-DDT	51.0 P	41.0 U	8-10
BCP110	ALPHA-BHC	2.1 UY	120.0	8-10
BCP110	BETA-BHC	16.0 P	21.0 U	8-10
BCP110	DELTA-BHC	120.0 PE	21.0 U	8-10
BCP110	ENDOSULFAN I	2.8	21.0 U	8-10
BCP110	GAMMA-BHC	73.0 PE	21.0 U	8-10
BCP114	ALPHA-BHC	31.0		12-14
BCP114	DELTA-BHC	5.6		12-14
BCP114	GAMMA-BHC	3.1		12-14
BCP132	ALL ANALYTES QUALIFIED AS U			30-32
BCP132DUP	ALL ANALYTES QUALIFIED AS U			30-32
BCP204	ALL ANALYTES QUALIFIED AS U			2-4
BCP210	ALL ANALYTES QUALIFIED AS U			8-10
BCP216	ALL ANALYTES QUALIFIED AS U			14-16
BCP220	ALL ANALYTES QUALIFIED AS U			18-20

Preliminary Data

CPC Plant - Pesticides/PCBs

Qualifiers

D - Compound identified in diluted sample analysis.

E - This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis.

U - Analyzed for but not detected.

P - Target analyte has greater than 25% difference for detected concentrations between the two GC columns.

X - Value from one column did not agree within a factor of two with the value from the other column.

Y - Saturated peaks are present in the area of the target analyte on one or both of the columns. A non-detect for this analyte may be erroneous.

Z - The analyte was not detected at a high dilution factor.

Note: Compounds qualified as U in both the original and diluted analyses are not reported.

Preliminary Data

CPC Plant - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BCP104	ANTIMONY		6.40	U	2-4
BCP104	ARSENIC	3.50			2-4
BCP104	BERYLLIUM	.79		B	2-4
BCP104	CADMIUM	1.90			2-4
BCP104	CHROMIUM	45.60			2-4
BCP104	COPPER	10.50			2-4
BCP104	CYANIDE		1.30	U	2-4
BCP104	LEAD	13.80		N*	2-4
BCP104	MERCURY		.13	U	2-4
BCP104	NICKEL		3.50	U	2-4
BCP104	SELENIUM		.92	UN	2-4
BCP104	SILVER	7.50		N	2-4
BCP104	THALLIUM		.39	U	2-4
BCP104	ZINC	24.30		*	2-4
BCP110	ANTIMONY		6.00	U	8-10
BCP110	ARSENIC	2.72		S	8-10
BCP110	BERYLLIUM	.71		B	8-10
BCP110	CADMIUM		.72	U	8-10
BCP110	CHROMIUM	23.40			8-10
BCP110	COPPER	9.70			8-10
BCP110	CYANIDE		1.20	U	8-10
BCP110	LEAD	9.70		N*	8-10
BCP110	MERCURY		.12	U	8-10
BCP110	NICKEL		3.30	U	8-10
BCP110	SELENIUM		.87	UN	8-10
BCP110	SILVER	5.20		N	8-10
BCP110	THALLIUM		.37	U	8-10
BCP110	ZINC	19.30		*	8-10
BCP114	ANTIMONY	9.40		B	12-14
BCP114	ARSENIC		.89	U	12-14
BCP114	BERYLLIUM	.13		B	12-14
BCP114	CADMIUM		.70	U	12-14
BCP114	CHROMIUM	4.10			12-14
BCP114	COPPER	2.70		B	12-14
BCP114	CYANIDE		1.20	U	12-14
BCP114	LEAD	3.40		N*	12-14
BCP114	MERCURY		.12	U	12-14
BCP114	NICKEL		3.20	U	12-14
BCP114	SELENIUM		.84	UN	12-14
BCP114	SILVER		.72	UN	12-14
BCP114	THALLIUM		.36	U	12-14
BCP114	ZINC	6.80		*	12-14
BCP132	ANTIMONY	14.80			30-32

Preliminary Data

CPC Plant - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BCP132	ARSENIC		.80	U	30-32
BCP132	BERYLLIUM		.04	U	30-32
BCP132	CADMIUM		.62	U	30-32
BCP132	CHROMIUM	1.60		B	30-32
BCP132	COPPER	1.50		B	30-32
BCP132	CYANIDE		1.10	U	30-32
BCP132	LEAD	.58		BNW*	30-32
BCP132	MERCURY		.11	U	30-32
BCP132	NICKEL		2.90	U	30-32
BCP132	SELENIUM		.75	UN	30-32
BCP132	SILVER		.65	UN	30-32
BCP132	THALLIUM		.32	U	30-32
BCP132	ZINC	5.60		*	30-32
BCP132DUP	ANTIMONY	2.90			30-32
BCP132DUP	ARSENIC		.80	U	30-32
BCP132DUP	BERYLLIUM		.04	U	30-32
BCP132DUP	CADMIUM		.62	U	30-32
BCP132DUP	CHROMIUM	1.30		B	30-32
BCP132DUP	COPPER	1.30		B	30-32
BCP132DUP	CYANIDE		1.10	U	30-32
BCP132DUP	LEAD	.63		BNW*	30-32
BCP132DUP	MERCURY		.11	U	30-32
BCP132DUP	NICKEL		2.90	U	30-32
BCP132DUP	SELENIUM	.75		N	30-32
BCP132DUP	SILVER		.65	UN	30-32
BCP132DUP	THALLIUM		.32	U	30-32
BCP132DUP	ZINC	5.80		*	30-32
BCP204	ANTIMONY	8.60		B	2-4
BCP204	ARSENIC	1.70		BW	2-4
BCP204	BERYLLIUM	.49		B	2-4
BCP204	CADMIUM		.80	U	2-4
BCP204	CHROMIUM	33.10			2-4
BCP204	COPPER	5.20		B	2-4
BCP204	CYANIDE		1.40	U	2-4
BCP204	LEAD	9.50		N*	2-4
BCP204	MERCURY		.27	U	2-4
BCP204	NICKEL		3.60	U	2-4
BCP204	SELENIUM		.96	UN	2-4
BCP204	SILVER		.82	UN	2-4
BCP204	THALLIUM		.41	U	2-4
BCP204	ZINC	22.70		*	2-4
BCP210	ANTIMONY		5.80	U	8-10
BCP210	ARSENIC		.88	U	8-10
BCP210	BERYLLIUM	.17		B	8-10

Preliminary Data

CPC Plant - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BCP210	CADMIUM		.69	U	8-10
BCP210	CHROMIUM	8.90			8-10
BCP210	COPPER	3.60		B	8-10
BCP210	CYANIDE		1.20	U	8-10
BCP210	LEAD	12.50		N*	8-10
BCP210	MERCURY		.24	U	8-10
BCP210	NICKEL		3.20	U	8-10
BCP210	SELENIUM		.84	UN	8-10
BCP210	SILVER		.72	UN	8-10
BCP210	THALLIUM		.36	U	8-10
BCP210	ZINC	17.40		*	8-10
BCP216	ANTIMONY		5.50	U	14-16
BCP216	ARSENIC	1.00		BW	14-16
BCP216	BERYLLIUM	.36		B	14-16
BCP216	CADMIUM		.66	U	14-16
BCP216	CHROMIUM	8.50			14-16
BCP216	COPPER	3.50		B	14-16
BCP216	CYANIDE		1.10	U	14-16
BCP216	LEAD	7.80		N*	14-16
BCP216	MERCURY		.23	U	14-16
BCP216	NICKEL		3.00	U	14-16
BCP216	SELENIUM		.79	UN	14-16
BCP216	SILVER		.68	UN	14-16
BCP216	THALLIUM		.34	UW	14-16
BCP216	ZINC	45.60		*	14-16
BCP220	ANTIMONY		5.00	U	18-20
BCP220	ARSENIC		.76	U	18-20
BCP220	BERYLLIUM	.04		B	18-20
BCP220	CADMIUM		.60	U	18-20
BCP220	CHROMIUM	1.20		B	18-20
BCP220	COPPER	.52		B	18-20
BCP220	CYANIDE		1.00	U	18-20
BCP220	LEAD	1.70		N*	18-20
BCP220	MERCURY		.21	U	18-20
BCP220	NICKEL		2.70	U	18-20
BCP220	SELENIUM		.72	UN	18-20
BCP220	SILVER		.62	UN	18-20
BCP220	THALLIUM		.31	U	18-20
BCP220	ZINC	8.50		*	18-20

Preliminary Data

CPC Plant - Metals

Qualifiers

U - Analyzed for but not detected.

B - Reported value less than the Contract Required Detection Limit but greater than or equal to the Instrument Detection Limit.

J - Estimated quantity.

N - Spiked sample recovery not within control limits.

S - Value determined by Method of Standard Additions (MSA)

W - Post digestion spike for Furnace AA out of control limits; sample absorbance less than 50% of spike absorbance.

* - Duplicate sample analysis not within control limits.

Preliminary Data

Old Plant Landfill Drainage Ditch - Volatiles

Sample Id	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
BLD101	2-BUTANONE	14 B	0-1
BLD101	ACETONE	17 B	0-1
BLD101	METHYLENE CHLORIDE	41 B	0-1
BLD110	2-BUTANONE	14 B	1-10
BLD110	ACETONE	19 B	1-10
BLD110	METHYLENE CHLORIDE	60 B	1-10

Qualifiers

B - Compound found in both the associated blank and the sample.

J - Estimated quantity.

D - Compound identified in diluted sample analysis.

Note: Only detected compounds are listed.

Preliminary Data

Old Plant Landfill Drainage Ditch - Semivolatiles

Sample ID	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
BLD101	HEXACHLOROBENZENE	5600 D	0-1
BLD110	HEXACHLOROBENZENE	2700	1-10

Qualifiers

B - Compound found in both the associated blank and the sample.

J - Estimated quantity.

D - Compound identified in diluted sample analysis.

Note: Only detected compounds are listed.

Preliminary Data

Old Plant Landfill Drainage Ditch - Pesticides/PCBs

Sample Id	Parameter	(UG/KG)	(UG/KG)	(FEET)
BLD101	ALL ANALYTES QUALIFIED AS U			0-1
BLD110	4,4'-DDE	5.1		1-10
BLD110	BETA-BHC	2.4		1-10

Qualifiers

D - Compound identified in diluted sample analysis.

E - This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis.

U - Analyzed for but not detected.

P - Target analyte has greater than 25% difference for detected concentrations between the two GC columns.

X - Value from one column did not agree within a factor of two with the value from the other column.

Y - Saturated peaks are present in the area of the target analyte on one or both of the columns. A non-detect for this analyte may be erroneous.

Z - The analyte was not detected at a high dilution factor.

Note: Compounds qualified as U in both the original and diluted analyses are not reported.

Preliminary Data

Old Plant Landfill Drainage Ditch - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BLD101	ANTIMONY		6.60	U	0-1
BLD101	ARSENIC	1.40		B	0-1
BLD101	BERYLLIUM	.43		B	0-1
BLD101	CADMIUM		.79	U	0-1
BLD101	CHROMIUM	26.80			0-1
BLD101	COPPER	6.50		B	0-1
BLD101	CYANIDE		1.40	U	0-1
BLD101	LEAD	9.80		N*	0-1
BLD101	MERCURY	.95			0-1
BLD101	NICKEL		3.60	U	0-1
BLD101	SELENIUM		.95	UN	0-1
BLD101	SILVER		.82	UN	0-1
BLD101	THALLIUM		.41	UW	0-1
BLD101	ZINC	97.00		*	0-1
BLD110	ANTIMONY	12.30		B	1-10
BLD110	ARSENIC	1.60		B	1-10
BLD110	BERYLLIUM	.30		B	1-10
BLD110	CADMIUM		.71	U	1-10
BLD110	CHROMIUM	21.00			1-10
BLD110	COPPER	5.20		B	1-10
BLD110	CYANIDE		1.20	U	1-10
BLD110	LEAD	6.40		N*	1-10
BLD110	MERCURY	10.20			1-10
BLD110	NICKEL		3.30	U	1-10
BLD110	SELENIUM		.86	UN	1-10
BLD110	SILVER		.73	UN	1-10
BLD110	THALLIUM		.37	UW	1-10
BLD110	ZINC	24.00			1-10

Qualifiers

U - Analyzed for but not detected.

B - Reported value less than the Contract Required Detection Limit but greater than or equal to the Instrument Detection Limit.

J - Estimated quantity.

N - Spiked sample recovery not within control limits.

W - Post digestion spike for Furnace AA out of control limits; sample absorbance less than 50% of spike absorbance.

* - Duplicate sample analysis not within control limits.

Preliminary Data

Sanitary Landfill - Volatiles

Sample Id	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
BSL107	2-BUTANONE	18 B	0-7
BSL107	ACETONE	59 B	0-7
BSL107	CHLOROBENZENE	100	0-7
BSL107	METHYLENE CHLORIDE	36 B	0-7
BSL212	2-BUTANONE	1200 BJ	0-12
BSL212	ACETONE	1100 J	0-12
BSL212	CARBON DISULFIDE	870 J	0-12
BSL212	CHLOROBENZENE	5700	0-12
BSL212	METHYLENE CHLORIDE	1300 BJ	0-12
BSL312	2-BUTANONE	19 B	0-12
BSL312	ACETONE	95 B	0-12
BSL312	CARBON DISULFIDE	6 J	0-12
BSL312	CHLOROBENZENE	37	0-12
BSL312	ETHYLBENZENE	2 J	0-12
BSL312	METHYLENE CHLORIDE	54 B	0-12

Qualifiers

B - Compound found in both the associated blank and the sample.

J - Estimated quantity.

Note: Only detected compounds are listed.

Preliminary Data

Sanitary Landfill - Semivolatiles

Sample ID	Parameter	Reported Conc. (UG/KG)		Depth (FEET)
BSL107	1,2,4,5-TETRACHLOROBENZENE	2900		0-7
BSL107	1,2,4-TRICHLOROBENZENE	430		0-7
BSL107	1,3-DICHLOROBENZENE	1000		0-7
BSL107	1,4-DICHLOROBENZENE	670		0-7
BSL107	BENZO(A)ANTHRACENE	56	J	0-7
BSL107	BENZO(A)PYRENE	43	J	0-7
BSL107	BENZO(B)FLUORANTHENE	48	J	0-7
BSL107	BENZO(K)FLUORANTHENE	58	J	0-7
BSL107	BIS(2-ETHYLHEXYL)PHTHALATE	770		0-7
BSL107	CHRYSENE	65	J	0-7
BSL107	FLUORANTHENE	120	J	0-7
BSL107	HEXACHLOROBENZENE	44000	D	0-7
BSL107	PHENANTHRENE	93	J	0-7
BSL107	PYRENE	130	J	0-7
BSL212	1,2,4,5-TETRACHLOROBENZENE	610		0-12
BSL212	1,2,4-TRICHLOROBENZENE	560		0-12
BSL212	1,3-DICHLOROBENZENE	370	J	0-12
BSL212	1,4-DICHLOROBENZENE	1200		0-12
BSL212	ACENAPHTHENE	56	J	0-12
BSL212	BIS(2-ETHYLHEXYL)PHTHALATE	150	J	0-12
BSL212	FLUORENE	41	J	0-12
BSL212	HEXACHLOROBENZENE	9500	D	0-12
BSL212	PHENANTHRENE	160	J	0-12
BSL312	1,2,4,5-TETRACHLOROBENZENE	6600		0-12
BSL312	1,2,4-TRICHLOROBENZENE	7400		0-12
BSL312	1,2-DICHLOROBENZENE	2400		0-12
BSL312	1,3-DICHLOROBENZENE	400	J	0-12
BSL312	1,4-DICHLOROBENZENE	1800		0-12
BSL312	2-METHYLNAPHTHALENE	230	J	0-12
BSL312	ACENAPHTHENE	790	J	0-12
BSL312	ANTHRACENE	880	J	0-12
BSL312	BENZO(A)ANTHRACENE	1100	J	0-12
BSL312	BENZO(A)PYRENE	740	J	0-12
BSL312	BENZO(B)FLUORANTHENE	810	J	0-12
BSL312	BENZO(G,H,I)PERYLENE	450	J	0-12
BSL312	BENZO(K)FLUORANTHENE	1000	J	0-12
BSL312	CARBAZOLE	550	J	0-12
BSL312	CHRYSENE	1300	J	0-12
BSL312	DIBENZOFURAN	450	J	0-12
BSL312	FLUORANTHENE	4000		0-12
BSL312	FLUORENE	900	J	0-12
BSL312	HEXACHLOROBENZENE	26000	D	0-12
BSL312	INDENO(1,2,3-CD)PYRENE	430	J	0-12
BSL312	NAPHTHALENE	690	J	0-12
BSL312	PHENANTHRENE	4600		0-12
BSL312	PYRENE	3100		0-12

Preliminary Data

Sanitary Landfill - Semivolatiles

Qualifiers

B - Compound found in both the associated blank and the sample.

J - Estimated quantity.

D - Compound identified in diluted sample analysis.

Note: Only detected compounds are listed.

Preliminary Data

Sanitary Landfill - Pesticides/PCBs

Sample Id	Parameter	Reported Conc. (UG/KG)	Diluted Conc. (UG/KG)	Depth (FEET)
BSL107	AROCLOR - 1254	140.0	400.0 U	0-7
BSL212	4,4'-DDE	8.8 P	41.0 U	0-12
BSL212	ENDRIN ALDEHYDE	6.7	41.0 U	0-12
BSL212	GAMMA-CHLORDANE	3.6 P	21.0 U	0-12
BSL312	AROCLOR - 1248	540.0 P		0-12
BSL312	AROCLOR - 1254	470.0 P		0-12

Qualifiers

D - Compound identified in diluted sample analysis.

E - This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis.

U - Analyzed for but not detected.

P - Target analyte has greater than 25% difference for detected concentrations between the two GC columns.

X - Value from one column did not agree within a factor of two with the value from the other column.

Y - Saturated peaks are present in the area of the target analyte on one or both of the columns. A non-detect for this analyte may be erroneous.

Z - The analyte was not detected at a high dilution factor.

Note: Compounds qualified as U in both the original and diluted analyses are not reported.

Preliminary Data

Sanitary Landfill - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BSL107	ANTIMONY	7.20		B	0-7
BSL107	ARSENIC	2.80			0-7
BSL107	BERYLLIUM	.45		B	0-7
BSL107	CADMIUM		.68	U	0-7
BSL107	CHROMIUM	21.30			0-7
BSL107	COPPER	7.20			0-7
BSL107	CYANIDE		1.20	U	0-7
BSL107	LEAD	16.20		N*	0-7
BSL107	MERCURY	7.80			0-7
BSL107	NICKEL		3.10	U	0-7
BSL107	SELENIUM	2.20		N	0-7
BSL107	SILVER		.70	UN	0-7
BSL107	THALLIUM		.35	UW	0-7
BSL107	ZINC	30.50		*	0-7
BSL212	ANTIMONY		5.70	U	0-12
BSL212	ARSENIC	3.30			0-12
BSL212	BERYLLIUM	.47		B	0-12
BSL212	CADMIUM		.68	U	0-12
BSL212	CHROMIUM	23.30			0-12
BSL212	COPPER	14.50			0-12
BSL212	CYANIDE		1.20	U	0-12
BSL212	LEAD	12.50		N*	0-12
BSL212	MERCURY	10.60			0-12
BSL212	NICKEL	4.20		B	0-12
BSL212	SELENIUM		.82	UN	0-12
BSL212	SILVER		.70	UN	0-12
BSL212	THALLIUM		.35	UW	0-12
BSL212	ZINC	45.90		*	0-12
BSL312	ANTIMONY		6.10	U	0-12
BSL312	ARSENIC	4.10			0-12
BSL312	BERYLLIUM	.45		B	0-12
BSL312	CADMIUM		.73	U	0-12
BSL312	CHROMIUM	36.40			0-12
BSL312	COPPER	17.10			0-12
BSL312	CYANIDE		1.30	U	0-12
BSL312	LEAD	62.50		N*	0-12
BSL312	MERCURY	27.10			0-12
BSL312	NICKEL	7.40		B	0-12
BSL312	SELENIUM		.88	UN	0-12
BSL312	SILVER		.76	UN	0-12
BSL312	THALLIUM		.38	UW	0-12
BSL312	ZINC	54.70		*	0-12

Preliminary Data

Sanitary Landfill - Metals

Qualifiers

U - Analyzed for but not detected.

B - Reported value less than the Contract Required Detection Limit but greater than or equal to the Instrument Detection Limit.

J - Estimated quantity.

N - Spiked sample recovery not within control limits.

W - Post digestion spike for Furnace AA out of control limits; sample absorbance less than 50% of spike absorbance.

* - Duplicate sample analysis not within control limits.

Preliminary Data

Old Plant Landfill - Volatiles

Sample Id	Parameter	Reported Conc. (UG/KG)		Depth (FEET)
BOP112	2-BUTANONE	1700	B	10-12
BOP112	CHLOROBENZENE	6300		10-12
BOP112	METHYLENE CHLORIDE	950	BJ	10-12
BOP121	BENZENE	2400		12-21
BOP121	CARBON DISULFIDE	1200	BJ	12-21
BOP121	CHLOROBENZENE	60000	D	12-21
BOP121	CHLOROFORM	370	J	12-21
BOP121	METHYLENE CHLORIDE	2600	B	12-21
BOP121	TETRACHLOROETHENE	200	J	12-21
BOP128	2-BUTANONE	1300	BJ	26-28
BOP128	ACETONE	650	BJ	26-28
BOP128	BENZENE	3300		26-28
BOP128	CARBON DISULFIDE	1600		26-28
BOP128	CHLOROBENZENE	7300		26-28
BOP128	METHYLENE CHLORIDE	1200	BJ	26-28
BOP140	2-BUTANONE	2000	BJ	38-40
BOP140	ACETONE	940	J	38-40
BOP140	CHLOROBENZENE	32000		38-40
BOP140	METHYLENE CHLORIDE	1300	BJ	38-40
BOP148	2-BUTANONE	1100	BJ	46-48
BOP148	ACETONE	480	J	46-48
BOP148	BENZENE	2300		46-48
BOP148	CARBON DISULFIDE	400	J	46-48
BOP148	CHLOROBENZENE	36000	D	46-48
BOP148	METHYLENE CHLORIDE	810	BJ	46-48
BOP208	2-BUTANONE	16	B	2-8
BOP208	ACETONE	36	B	2-8
BOP208	CHLOROBENZENE	4	J	2-8
BOP208	CHLOROFORM	9	J	2-8
BOP208	METHYLENE CHLORIDE	49	B	2-8
BOP219	2-BUTANONE	42		18-19
BOP219	ACETONE	380	BD	18-19
BOP219	BENZENE	9	J	18-19
BOP219	CHLOROBENZENE	29		18-19
BOP219	CHLOROFORM	54		18-19
BOP219	METHYLENE CHLORIDE	14	B	18-19

Preliminary Data

Old Plant Landfill - Volatiles

Sample Id	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
BOP221	2-BUTANONE	28 B	20-21
BOP221	ACETONE	410 BD	20-21
BOP221	BENZENE	51	20-21
BOP221	CARBON DISULFIDE	10 J	20-21
BOP221	CHLOROBENZENE	120	20-21
BOP221	CHLOROFORM	160	20-21
BOP221	METHYLENE CHLORIDE	21 B	20-21
BOP230	2-BUTANONE	12	28-30
BOP230	ACETONE	12	28-30
BOP230	METHYLENE CHLORIDE	48 B	28-30
BOP240	2-BUTANONE	6 J	38-40
BOP240	ACETONE	68 B	38-40
BOP240	CHLOROBENZENE	1 J	38-40
BOP240	CHLOROFORM	33	38-40
BOP240	METHYLENE CHLORIDE	22 B	38-40
BOP240DUP	2-BUTANONE	4 J	38-40
BOP240DUP	ACETONE	41 B	38-40
BOP240DUP	CHLOROBENZENE	2 J	38-40
BOP240DUP	CHLOROFORM	31	38-40
BOP240DUP	METHYLENE CHLORIDE	14 B	38-40
BOP305	2-BUTANONE	16 B	4-5
BOP305	ACETONE	69 B	4-5
BOP305	CARBON DISULFIDE	14	4-5
BOP305	CHLOROBENZENE	57	4-5
BOP305	METHYLENE CHLORIDE	58 B	4-5
BOP325	2-BUTANONE	7 BJ	24-25
BOP325	ACETONE	6 BJ	24-25
BOP325	CHLOROBENZENE	7 J	24-25
BOP325	CHLOROFORM	4 J	24-25
BOP325	METHYLENE CHLORIDE	10 BJ	24-25
BOP340	2-BUTANONE	11 J	38-40
BOP340	ACETONE	15	38-40
BOP340	CHLOROFORM	4 J	38-40
BOP340	METHYLENE CHLORIDE	48 B	38-40

Preliminary Data

Old Plant Landfill - Volatiles

Sample Id	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
BOP342	2-BUTANONE	8 J	40-42
BOP342	ACETONE	17	40-42
BOP342	METHYLENE CHLORIDE	75 B	40-42
BOP406	2-BUTANONE	570 J	4-6
BOP406	ACETONE	370 J	4-6
BOP406	CARBON DISULFIDE	140 J	4-6
BOP406	CHLOROBENZENE	9700	4-6
BOP406	METHYLENE CHLORIDE	1000 BJ	4-6
BOP420	2-BUTANONE	1100 BJ	18-20
BOP420	ACETONE	990 J	18-20
BOP420	CARBON DISULFIDE	3300	18-20
BOP420	CHLOROBENZENE	1800	18-20
BOP420	METHYLENE CHLORIDE	3400 B	18-20
BOP422	1,1,1-TRICHLOROETHANE	530 J	20-22
BOP422	2-BUTANONE	1700 BJ	20-22
BOP422	ACETONE	2700 J	20-22
BOP422	CARBON DISULFIDE	1500 J	20-22
BOP422	CHLOROBENZENE	46000	20-22
BOP422	METHYLENE CHLORIDE	2200 BJ	20-22
BOP440	2-BUTANONE	5 BJ	38-40
BOP440	ACETONE	8 BJ	38-40
BOP440	METHYLENE CHLORIDE	17 B	38-40

Qualifiers

B - Compound found in both the associated blank and the sample.

J - Estimated quantity.

D - Compound identified in diluted sample analysis.

Note: Only detected compounds are listed.

Preliminary Data

Old Plant Landfill - Semivolatiles

3 8 145

Sample ID	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
BOP112	1,2,4,5-TETRACHLOROBENZENE	260 J	10-12
BOP112	1,2,4-TRICHLOROBENZENE	750	10-12
BOP112	1,2-DICHLOROBENZENE	2900	10-12
BOP112	1,3-DICHLOROBENZENE	160 J	10-12
BOP112	1,4-DICHLOROBENZENE	2700	10-12
BOP112	HEXACHLOROBENZENE	19000 D	10-12
BOP121	1,2,4,5-TETRACHLOROBENZENE	30000	12-21
BOP121	1,2,4-TRICHLOROBENZENE	30000	12-21
BOP121	1,2-DICHLOROBENZENE	120000 D	12-21
BOP121	1,3-DICHLOROBENZENE	7100	12-21
BOP121	1,4-DICHLOROBENZENE	120000 D	12-21
BOP121	HEXACHLOROBENZENE	140000 D	12-21
BOP121	PHENOL	3100 J	12-21
BOP128	1,2-DICHLOROBENZENE	1800	26-28
BOP128	1,4-DICHLOROBENZENE	2200	26-28
BOP140	1,2,4,5-TETRACHLOROBENZENE	4100 D	38-40
BOP140	1,2,4-TRICHLOROBENZENE	4600 D	38-40
BOP140	1,2-DICHLOROBENZENE	7500 D	38-40
BOP140	1,3-DICHLOROBENZENE	150 J	38-40
BOP140	1,4-DICHLOROBENZENE	15000 D	38-40
BOP140	HEXACHLOROBENZENE	1200	38-40
BOP148	1,2,4,5-TETRACHLOROBENZENE	670	46-48
BOP148	1,2,4-TRICHLOROBENZENE	790	46-48
BOP148	1,2-DICHLOROBENZENE	6400 D	46-48
BOP148	1,3-DICHLOROBENZENE	280 J	46-48
BOP148	1,4-DICHLOROBENZENE	8500 D	46-48
BOP148	HEXACHLOROBENZENE	240 J	46-48
BOP208	1,2,4,5-TETRACHLOROBENZENE	150 J	2-8
BOP208	HEXACHLOROBENZENE	13000 D	2-8
BOP219	BIS(2-ETHYLHEXYL)PHTHALATE	51 BJ	18-19
BOP219	PHENOL	2900	18-19
BOP221	ALL ANALYTES QUALIFICED AS U		20-21
BOP230	BIS(2-ETHYLHEXYL)PHTHALATE	43 BJ	28-30
BOP230	PHENOL	5200	28-30

Preliminary Data

Old Plant Landfill - Semivolatiles

Sample ID	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
BOP240	BIS(2-ETHYLHEXYL)PHTHALATE	65 BJ	38-40
BOP240DUP	ALL ANALYTES QUALIFIED AS U		38-40
BOP305	1,2,4,5-TETRACHLOROBENZENE	16000	4-5
BOP305	1,2,4-TRICHLOROBENZENE	20000	4-5
BOP305	1,2-DICHLOROBENZENE	110000 D	4-5
BOP305	1,3-DICHLOROBENZENE	6600	4-5
BOP305	1,4-DICHLOROBENZENE	120000 D	4-5
BOP305	HEXACHLOROBENZENE	110000 D	4-5
BOP325	ALL ANALYTES QUALIFIED AS U		24-25
BOP340	ALL ANALYTES QUALIFIED AS U		38-40
BOP342	ALL ANALYTES QUALIFIED AS U		40-42
BOP406	1,2,4,5-TETRACHLOROBENZENE	32000	4-6
BOP406	1,2,4-TRICHLOROBENZENE	6400	4-6
BOP406	1,2-DICHLOROBENZENE	2100 J	4-6
BOP406	1,3-DICHLOROBENZENE	1900 J	4-6
BOP406	1,4-DICHLOROBENZENE	17000	4-6
BOP406	BIS(2-ETHYLHEXYL)PHTHALATE	1500 J	4-6
BOP406	FLUORANTHENE	420 J	4-6
BOP406	HEXACHLOROBENZENE	170000 D	4-6
BOP406	NAPHTHALENE	2600 J	4-6
BOP406	PHENANTHRENE	410 J	4-6
BOP406	PYRENE	440 J	4-6
BOP420	1,2,4,5-TETRACHLOROBENZENE	220 J	18-20
BOP420	1,2,4-TRICHLOROBENZENE	710 J	18-20
BOP420	1,2-DICHLOROBENZENE	57000 D	18-20
BOP420	1,3-DICHLOROBENZENE	5000	18-20
BOP420	1,4-DICHLOROBENZENE	74000 D	18-20
BOP420	2-CHLOROPHENOL	440 J	18-20
BOP420	HEXACHLOROBENZENE	400 J	18-20
BOP420	PHENOL	3700	18-20
BOP422	1,2,4,5-TETRACHLOROBENZENE	800 J	20-22
BOP422	1,2,4-TRICHLOROBENZENE	1600 J	20-22
BOP422	1,2-DICHLOROBENZENE	130000 D	20-22

Preliminary Data

Old Plant Landfill - Semivolatiles

Sample ID	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
BOP422	1,3-DICHLOROBENZENE	11000	20-22
BOP422	1,4-DICHLOROBENZENE	150000 D	20-22
BOP422	HEXACHLOROBENZENE	880 J	20-22
BOP440	BIS(2-ETHYLHEXYL)PHTHALATE	81 BJ	38-40
BOP440	PHENOL	11000 D	38-40

Qualifiers

B - Compound found in both the associated blank and the sample.

J - Estimated quantity.

D - Compound identified in diluted sample analysis.

Note: Only detected compounds are listed.

Preliminary Data

Old Plant Landfill - Pesticides/PCBs

Sample Id	Parameter	Reported Conc. (UG/KG)	Diluted Conc. (UG/KG)	Depth (FEET)
BOP112	ALPHA-BHC	22.0		10-12
BOP112	BETA-BHC	9.0 P		10-12
BOP112	DELTA-BHC	2.4 P		10-12
BOP112	ENDOSULFAN I	5.3 P		10-12
BOP121	4,4'-DDD	54.0 PD	430.0 UD	12-21
BOP121	4,4'-DDE	97.0 PD	430.0 UD	12-21
BOP121	4,4'-DDT	70.0 D	430.0 UD	12-21
BOP121	ALPHA-BHC	650.0 PEYD	680.0 PD	12-21
BOP121	BETA-BHC	540.0 PED	220.0 UD	12-21
BOP121	DELTA-BHC	170.0 PYD	220.0 UZD	12-21
BOP121	ENDOSULFAN II	54.0 PD	430.0 UD	12-21
BOP121	GAMMA-CHLORDANE	33.0 PD	220.0 UD	12-21
BOP128	ALL ANALYTES QUALIFIED AS U			26-28
BOP140	4,4'-DDE	52.0 PE	59.0 P	38-40
BOP140	ALDRIN	7.0 P	18.0 U	38-40
BOP140	ALPHA-BHC	120.0 PE	270.0	38-40
BOP140	BETA-BHC	62.0 PE	71.0 P	38-40
BOP140	DELTA-BHC	23.0	18.0 U	38-40
BOP140	DIELDRIN	6.3 P	34.0 U	38-40
BOP140	GAMMA-BHC	38.0 PE	44.0 P	38-40
BOP140	GAMMA-CHLORDANE	18.0 P	18.0 U	38-40
BOP140	HEPTACHLOR	6.5 P	18.0 U	38-40
BOP140	METHOXYCHLOR	40.0	180.0 U	38-40
BOP148	4,4'-DDE	15.0 P	40.0 U	46-48
BOP148	ALPHA-BHC	80.0 E	67.0	46-48
BOP148	BETA-BHC	17.0 P	21.0 U	46-48
BOP148	DELTA-BHC	5.5	21.0 U	46-48
BOP148	GAMMA-BHC	13.0 P	21.0 U	46-48
BOP148	GAMMA-CHLORDANE	2.7 P	21.0 U	46-48
BOP148	HEPTACHLOR	2.5 P	21.0 U	46-48
BOP208	4,4'-DDE	34.0	42.0 UD	2-8
BOP208	4,4'-DDT	25.0 P	42.0 UD	2-8
BOP208	ALPHA-BHC	2.2 UY	860.0 ED	2-8
BOP208	BETA-BHC	240.0 E	230.0 D	2-8
BOP208	DELTA-BHC	95.0 E	22.0 UD	2-8
BOP208	ENDOSULFAN II	5.5	42.0 UD	2-8
BOP208	GAMMA-BHC	200.0 PE	120.0 D	2-8
BOP219	ALPHA-BHC	22.0		18-19
BOP219	GAMMA-BHC	9.2 P		18-19

Preliminary Data

Old Plant Landfill - Pesticides/PCBs

Sample Id	Parameter	Reported Conc. (UG/KG)	Diluted Conc. (UG/KG)	Depth (FEET)
BOP221	ALPHA-BHC	25.0 Y		20-21
BOP221	BETA-BHC	7.0 P		20-21
BOP221	GAMMA-BHC	9.3 P		20-21
BOP230	ALPHA-BHC	2.3 P		28-30
BOP230	BETA-BHC	2.6 P		28-30
BOP230	GAMMA-CHLORDANE	2.8 P		28-30
BOP240	ALL ANALYTES QUALIFIED AS U			38-40
BOP240DUP	ALL ANALYTES QUALIFIED AS U			38-40
BOP305	4,4'-DDD	90.0 PE	86.0 PD	4-5
BOP305	4,4'-DDE	100.0 E	100.0 D	4-5
BOP305	ALPHA-BHC	89.0 PY	150.0 D	4-5
BOP305	BETA-BHC	51.0 PY	67.0 PD	4-5
BOP305	DELTA-BHC	25.0 P	34.0 D	4-5
BOP305	ENDOSULFAN I	26.0 P	28.0 PD	4-5
BOP305	ENDOSULFAN SULFATE	31.0 P	37.0 UD	4-5
BOP305	ENDRIN ALDEHYDE	99.0 PE	37.0 UD	4-5
BOP305	GAMMA-BHC	10.0 PY	19.0 UD	4-5
BOP305	GAMMA-CHLORDANE	29.0 P	69.0 PD	4-5
BOP305	HEPTACHLOR	23.0	28.0 PD	4-5
BOP305	METHOXYCHLOR	41.0 P	190.0 UD	4-5
BOP325	ALL ANALYTES QUALIFIED AS U			24-25
BOP340	ALL ANALYTES QUALIFIED AS U			38-40
BOP342	ALL ANALYTES QUALIFIED AS U			40-42
BOP406	4,4'-DDE	23.0 P	42.0 PD	4-6
BOP406	ALPHA-BHC	37.0 PEY	98.0 PXD	4-6
BOP406	ALPHA-CHLORDANE	16.0 P	36.0 PD	4-6
BOP406	AROCLOR - 1260	390.0 P	940.0 D	4-6
BOP406	BETA-BHC	1.9 UY	19.0 UD	4-6
BOP406	DELTA-BHC	1.9 UY	19.0 UD	4-6
BOP406	GAMMA-BHC	1.9 UY	19.0 UD	4-6
BOP406	GAMMA-CHLORDANE	12.0 P	19.0 UD	4-6
BOP420	4,4'-DDT	5.8 P	44.0 UD	18-20

Preliminary Data

Old Plant Landfill - Pesticides/PCBs

Sample Id	Parameter	Reported Conc. (UG/KG)	Diluted Conc. (UG/KG)	Depth (FEET)
BOP420	ALPHA-BHC	190.0 PEY	520.0 ED	18-20
BOP420	BETA-BHC	88.0 E	83.0 PD	18-20
BOP420	DELTA-BHC	88.0 PE	75.0 D	18-20
BOP420	DIELDRIN	6.0 P	44.0 UD	18-20
BOP420	GAMMA-BHC	100.0 PEY	110.0 D	18-20
BOP420	GAMMA-CHLORDANE	4.8 P	23.0 UD	18-20
BOP420	HEPTACHLOR	2.3 PEY	23.0 UD	18-20
BOP422	4,4'-DDE	5.0	42.0 UD	20-22
BOP422	ALPHA-BHC	180.0 PEY	670.0 ED	20-22
BOP422	ALPHA-CHLORDANE	2.6	22.0 UD	20-22
BOP422	BETA-BHC	97.0 E	100.0 PD	20-22
BOP422	DELTA-BHC	100.0 EY	93.0 PD	20-22
BOP422	DIELDRIN	5.1 P	42.0 UD	20-22
BOP422	GAMMA-BHC	110.0 PEY	140.0 PD	20-22
BOP422	GAMMA-CHLORDANE	4.9 P	22.0 UD	20-22
BOP440	ALPHA-BHC	10.0 P		38-40
BOP440	BETA-BHC	3.5 P		38-40
BOP440	GAMMA-BHC	2.0		38-40

Qualifiers

D - Compound identified in diluted sample analysis.

E - This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis.

U - Analyzed for but not detected.

P - Target analyte has greater than 25% difference for detected concentrations between the two GC columns.

X - Value from one column did not agree within a factor of two with the value from the other column.

Y - Saturated peaks are present in the area of the target analyte on one or both of the columns. A non-detect for this analyte may be erroneous.

Z - The analyte was not detected at a high dilution factor.

Note: Compounds qualified as U in both the original and diluted analyses are not reported.

Preliminary Data

Old Plant Landfill - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BOP112	ANTIMONY		6.00	U	10-12
BOP112	ARSENIC	2.90			10-12
BOP112	BERYLLIUM	.76		B	10-12
BOP112	CADMIUM		.76	U	10-12
BOP112	CHROMIUM	31.60			10-12
BOP112	COPPER	8.30			10-12
BOP112	CYANIDE		1.20	U	10-12
BOP112	LEAD	8.30		N*	10-12
BOP112	MERCURY		.25	U	10-12
BOP112	NICKEL	7.90		B	10-12
BOP112	SELENIUM		.87	UN	10-12
BOP112	SILVER		.75	UN	10-12
BOP112	THALLIUM		.37	UW	10-12
BOP112	ZINC	40.30		*	10-12
BOP121	ANTIMONY	6.50		UN	12-21
BOP121	ARSENIC	.99		UWN	12-21
BOP121	BERYLLIUM	.05		B	12-21
BOP121	CADMIUM	.77		U	12-21
BOP121	CHROMIUM	13.10		NE	12-21
BOP121	COPPER	1.20		B	12-21
BOP121	CYANIDE	1.30		U	12-21
BOP121	LEAD	1.60		*	12-21
BOP121	MERCURY	.42			12-21
BOP121	NICKEL	3.50		U	12-21
BOP121	SELENIUM	.93		UN	12-21
BOP121	SILVER	.80		UN	12-21
BOP121	THALLIUM	.40		U	12-21
BOP121	ZINC	51.70		E	12-21
BOP128	ANTIMONY		5.90	U	26-28
BOP128	ARSENIC	3.00			26-28
BOP128	BERYLLIUM	.58		B	26-28
BOP128	CADMIUM		.71	U	26-28
BOP128	CHROMIUM	16.00			26-28
BOP128	COPPER	6.90			26-28
BOP128	CYANIDE		1.20	U	26-28
BOP128	LEAD	9.40		N*	26-28
BOP128	MERCURY		.25	U	26-28
BOP128	NICKEL		3.30	U	26-28
BOP128	SELENIUM		.86	UNW	26-28
BOP128	SILVER		.74	UN	26-28
BOP128	THALLIUM		.37	UW	26-28
BOP128	ZINC	28.40			26-28
BOP140	ANTIMONY		5.00	U	38-40

Preliminary Data

Old Plant Landfill - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BOP140	ARSENIC		.77	U	38-40
BOP140	BERYLLIUM		.04	U	38-40
BOP140	CADMIUM		.60	U	38-40
BOP140	CHROMIUM	1.60		B	38-40
BOP140	COPPER	.96		B	38-40
BOP140	CYANIDE		1.00	U	38-40
BOP140	LEAD	1.60		N*	38-40
BOP140	MERCURY		.21	U	38-40
BOP140	NICKEL		2.80	U	38-40
BOP140	SELENIUM		.73	UNW	38-40
BOP140	SILVER		.62	UN	38-40
BOP140	THALLIUM	.40		BW	38-40
BOP140	ZINC	9.50		*	38-40
BOP148	ANTIMONY		5.90	U	46-48
BOP148	ARSENIC		.90	UW	46-48
BOP148	BERYLLIUM		.05	U	46-48
BOP148	CADMIUM		.70	U	46-48
BOP148	CHROMIUM		.51	U	46-48
BOP148	COPPER		.51	U	46-48
BOP148	CYANIDE		1.20	U	46-48
BOP148	LEAD	1.00		N*	46-48
BOP148	MERCURY		.24	U	46-48
BOP148	NICKEL		3.20	U	46-48
BOP148	SELENIUM		.85	UN	46-48
BOP148	SILVER		.73	UN	46-48
BOP148	THALLIUM		.36	UW	46-48
BOP148	ZINC	5.40		*	46-48
BOP208	ANTIMONY	5.60		UN	2-8
BOP208	ARSENIC	.85		UWN	2-8
BOP208	BERYLLIUM	.05		U	2-8
BOP208	CADMIUM	1.70			2-8
BOP208	CHROMIUM	1.00		BNE	2-8
BOP208	COPPER	1.60		B	2-8
BOP208	CYANIDE	1.20		U	2-8
BOP208	LEAD	3.46		*S	2-8
BOP208	MERCURY	57.10			2-8
BOP208	NICKEL	3.10		U	2-8
BOP208	SELENIUM	.81		UWN	2-8
BOP208	SILVER	.69		UN	2-8
BOP208	THALLIUM	.35		U	2-8
BOP208	ZINC	5.70		E	2-8
BOP219	ANTIMONY	6.10		UN	18-19
BOP219	ARSENIC	4.70		UN	18-19
BOP219	BERYLLIUM	.09		B	18-19

Preliminary Data

Old Plant Landfill - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BOP219	CADMIUM	.73		U	18-19
BOP219	CHROMIUM	15.90		NE	18-19
BOP219	COPPER	5.70		B	18-19
BOP219	CYANIDE	1.30		U	18-19
BOP219	LEAD	8.90		*	18-19
BOP219	MERCURY	.13		U	18-19
BOP219	NICKEL	3.40		U	18-19
BOP219	SELENIUM	.88		UWN	18-19
BOP219	SILVER	.76		UN	18-19
BOP219	THALLIUM	.38		U	18-19
BOP219	ZINC	20.90		E	18-19
BOP221	ANTIMONY	6.10		UN	20-21
BOP221	ARSENIC	.93		UWN	20-21
BOP221	BERYLLIUM	.35		B	20-21
BOP221	CADMIUM	.84		B	20-21
BOP221	CHROMIUM	34.00		NE	20-21
BOP221	COPPER	6.40			20-21
BOP221	CYANIDE	4.20			20-21
BOP221	LEAD	1.30		U*	20-21
BOP221	MERCURY	.62			20-21
BOP221	NICKEL	3.30		U	20-21
BOP221	SELENIUM	.88		UWN	20-21
BOP221	SILVER	.75		UN	20-21
BOP221	THALLIUM	.38		U	20-21
BOP221	ZINC	20.10		E	20-21
BOP230	ANTIMONY	5.00		UN	28-30
BOP230	ARSENIC	.76		UN	28-30
BOP230	BERYLLIUM	.04		U	28-30
BOP230	CADMIUM	.60		U	28-30
BOP230	CHROMIUM	2.60		NE	28-30
BOP230	COPPER	.90		B	28-30
BOP230	CYANIDE	1.00		U	28-30
BOP230	LEAD	.45		B*	28-30
BOP230	MERCURY	.10		U	28-30
BOP230	NICKEL	2.70		U	28-30
BOP230	SELENIUM	.72		UWN	28-30
BOP230	SILVER	.62		UN	28-30
BOP230	THALLIUM	.31		U	28-30
BOP230	ZINC	2.70		BE	28-30
BOP240	ANTIMONY	6.10		UN	38-40
BOP240	ARSENIC	.93		UN	38-40
BOP240	BERYLLIUM	.05		U	38-40
BOP240	CADMIUM	.73		U	38-40
BOP240	CHROMIUM	.97		BNE	38-40

Preliminary Data

Old Plant Landfill - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BOP240	COPPER	1.10		B	38-40
BOP240	CYANIDE	1.30		U	38-40
BOP240	LEAD	.72		B*	38-40
BOP240	MERCURY	.13		U	38-40
BOP240	NICKEL	3.40		U	38-40
BOP240	SELENIUM	.88		UN	38-40
BOP240	SILVER	.76		UN	38-40
BOP240	THALLIUM	.38		U	38-40
BOP240	ZINC	2.60		BE	38-40
BOP240DUP	ANTIMONY	6.00		UN	38-40
BOP240DUP	ARSENIC	.92		UWN	38-40
BOP240DUP	BERYLLIUM	.05		U	38-40
BOP240DUP	CADMIUM	.72		U	38-40
BOP240DUP	CHROMIUM	1.10		BNE	38-40
BOP240DUP	COPPER	.52		U	38-40
BOP240DUP	CYANIDE	1.20		U	38-40
BOP240DUP	LEAD	.25		U*	38-40
BOP240DUP	MERCURY	.12		U	38-40
BOP240DUP	NICKEL	3.30		U	38-40
BOP240DUP	SELENIUM	.87		UWN	38-40
BOP240DUP	SILVER	.74		UN	38-40
BOP240DUP	THALLIUM	.37		U	38-40
BOP240DUP	ZINC	4.00		BE	38-40
BOP305	ANTIMONY	5.60		UN	4-5
BOP305	ARSENIC	.85		UWN	4-5
BOP305	BERYLLIUM	.52		B	4-5
BOP305	CADMIUM	.67		U	4-5
BOP305	CHROMIUM	19.90		NE	4-5
BOP305	COPPER	19.80			4-5
BOP305	CYANIDE	1.20		U	4-5
BOP305	LEAD	6.30		U*S	4-5
BOP305	MERCURY	21.70			4-5
BOP305	NICKEL	5.40		B	4-5
BOP305	SELENIUM	.81		UN	4-5
BOP305	SILVER	.69		UN	4-5
BOP305	THALLIUM	.35		U	4-5
BOP305	ZINC	69.60		E	4-5
BOP325	ANTIMONY	7.60		BN	24-25
BOP325	ARSENIC	.97		UN	24-25
BOP325	BERYLLIUM	.96		B	24-25
BOP325	CADMIUM	.76		U	24-25
BOP325	CHROMIUM	20.60		NE	24-25
BOP325	COPPER	13.10			24-25
BOP325	CYANIDE	1.30		U	24-25

Preliminary Data

3 8 146

Old Plant Landfill - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BOP325	LEAD	8.30		*	24-25
BOP325	MERCURY	.13		U	24-25
BOP325	NICKEL	3.50		U	24-25
BOP325	SELENIUM	.92		UN	24-25
BOP325	SILVER	.79		UN	24-25
BOP325	THALLIUM	.39		U	24-25
BOP325	ZINC	35.60		E	24-25
BOP340	ANTIMONY	5.60		UN	38-40
BOP340	ARSENIC	.86		UN	38-40
BOP340	BERYLLIUM	.05		U	38-40
BOP340	CADMIUM	1.40			38-40
BOP340	CHROMIUM	4.90		NE	38-40
BOP340	COPPER	1.90		B	38-40
BOP340	CYANIDE	1.20		U	38-40
BOP340	LEAD	1.50		*	38-40
BOP340	MERCURY	.12		U	38-40
BOP340	NICKEL	3.10		U	38-40
BOP340	SELENIUM	.81		UN	38-40
BOP340	SILVER	.70		UN	38-40
BOP340	THALLIUM	.35		U	38-40
BOP340	ZINC	10.50		E	38-40
BOP342	ANTIMONY	5.70		UN	40-42
BOP342	ARSENIC	4.50		N	40-42
BOP342	BERYLLIUM	.16		B	40-42
BOP342	CADMIUM	.73		B	40-42
BOP342	CHROMIUM	4.10		NE	40-42
BOP342	COPPER	2.30		B	40-42
BOP342	CYANIDE	1.20		U	40-42
BOP342	LEAD	1.70		*	40-42
BOP342	MERCURY	.12		U	40-42
BOP342	NICKEL	3.10		U	40-42
BOP342	SELENIUM	.82		UN	40-42
BOP342	SILVER	.71		UN	40-42
BOP342	THALLIUM	.35		U	40-42
BOP342	ZINC	9.30		E	40-42
BOP406	ANTIMONY	10.90		BN	4-6
BOP406	ARSENIC	.96		UWN	4-6
BOP406	BERYLLIUM	.23		B	4-6
BOP406	CADMIUM	.75		U	4-6
BOP406	CHROMIUM	31.40		NE	4-6
BOP406	COPPER	77.10			4-6
BOP406	CYANIDE	1.30		U	4-6
BOP406	LEAD	7.20		*S	4-6
BOP406	MERCURY	406.00			4-6

Preliminary Data

3 8 1465

Old Plant Landfill - Metals

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BOP406	NICKEL	8.50		B	4-6
BOP406	SELENIUM	.91		UWN	4-6
BOP406	SILVER	.78		UN	4-6
BOP406	THALLIUM	.39		U	4-6
BOP406	ZINC	168.00		E	4-6
BOP420	ANTIMONY	6.40		UN	18-20
BOP420	ARSENIC	.98		UWN	18-20
BOP420	BERYLLIUM	.74		B	18-20
BOP420	CADMIUM	.77		U	18-20
BOP420	CHROMIUM	32.70		NE	18-20
BOP420	COPPER	8.00			18-20
BOP420	CYANIDE	1.30		U	18-20
BOP420	LEAD	54.30		*	18-20
BOP420	MERCURY	.13		U	18-20
BOP420	NICKEL	3.50		U	18-20
BOP420	SELENIUM	.93		UN	18-20
BOP420	SILVER	.80		UN	18-20
BOP420	THALLIUM	.40		U	18-20
BOP420	ZINC	27.50		E	18-20
BOP422	ANTIMONY	5.60		UN	20-22
BOP422	ARSENIC	1.50		BWN	20-22
BOP422	BERYLLIUM	1.00		B	20-22
BOP422	CADMIUM	.87		B	20-22
BOP422	CHROMIUM	29.50		NE	20-22
BOP422	COPPER	8.10			20-22
BOP422	CYANIDE	1.20		U	20-22
BOP422	LEAD	3.80		*	20-22
BOP422	MERCURY	.12		U	20-22
BOP422	NICKEL	3.10		U	20-22
BOP422	SELENIUM	.81		UN	20-22
BOP422	SILVER	.69		UN	20-22
BOP422	THALLIUM	.35		U	20-22
BOP422	ZINC	125.00		E	20-22
BOP440	ANTIMONY	6.40		UN	38-40
BOP440	ARSENIC	4.90		UWN	38-40
BOP440	BERYLLIUM	.05		U	38-40
BOP440	CADMIUM	.76		U	38-40
BOP440	CHROMIUM	.55		UNE	38-40
BOP440	COPPER	1.10		B	38-40
BOP440	CYANIDE	1.30		U	38-40
BOP440	LEAD	.68		B*	38-40
BOP440	MERCURY	.13		U	38-40
BOP440	NICKEL	3.50		U	38-40
BOP440	SELENIUM	.92		UN	38-40

Preliminary Data

Old Plant Landfill - Metals

3 8 145

Sample Id	Parameter	Reported Conc. (MG/KG)	Detection Limit (MG/KG)	Qualifier	Depth (FEET)
BOP440	SILVER	.79		UN	38-40
BOP440	THALLIUM	.39		U	38-40
BOP440	ZINC	3.10		BE	38-40

Qualifiers

U - Analyzed for but no detected.

B - Reported value less than the Contract Required Detection Limit but greater than of equal to the Instrument Detection Limit.

E - Reported value estimated because of the presence of an impurity.

J - Estimated quantity.

N - Spiked sample recovery not within control limits.

W - Post digestion spike for Furnace AA out of control limits; sample absorbance less than 50% of spike absorbance.

* - Duplicate sample analysis not within control limits.

Preliminary Data

Wastewater Ditch - Volatiles

Sample Id	Parameter	Reported Conc. (UG/KG)	Depth (FEET)
SCOD154	ACETONE	160 B	6-7
SCOD154	BENZENE	150	6-7
SCOD154	CHLOROBENZENE	1000	6-7
SCOD154	METHYLENE CHLORIDE	50 BJ	6-7
SCOD155	ACETONE	18 B	7-8
SCOD155	BENZENE	6 J	7-8
SCOD155	CARBON DISULFIDE	16	7-8
SCOD155	CHLOROBENZENE	110	7-8
SCOD155	METHYLENE CHLORIDE	16 B	7-8
SCOD155DUP	ACETONE	38 B	7-8
SCOD155DUP	BENZENE	8 J	7-8
SCOD155DUP	CARBON DISULFIDE	12 J	7-8
SCOD155DUP	CHLOROBENZENE	110	7-8
SCOD155DUP	METHYLENE CHLORIDE	18 B	7-8
SCOD156	ACETONE	68 B	8-9
SCOD156	BENZENE	44	8-9
SCOD156	CHLOROBENZENE	340	8-9
SCOD156	METHYLENE CHLORIDE	56 B	8-9
SCOD157	ACETONE	13 B	9-10
SCOD157	CARBON DISULFIDE	2 J	9-10
SCOD157	CHLOROBENZENE	19	9-10
SCOD157	METHYLENE CHLORIDE	21 B	9-10
SCOD158	2-BUTANONE	3 J	10-11
SCOD158	ACETONE	63 B	10-11
SCOD158	BENZENE	11 J	10-11
SCOD158	CHLOROBENZENE	190	10-11
SCOD158	METHYLENE CHLORIDE	50 B	10-11

Qualifiers

B - Compound found in both the associated blank and the sample.

J - Estimated quantity.

Note: Only detected compounds are listed.